Manchester Piccadilly Station Options Assessment

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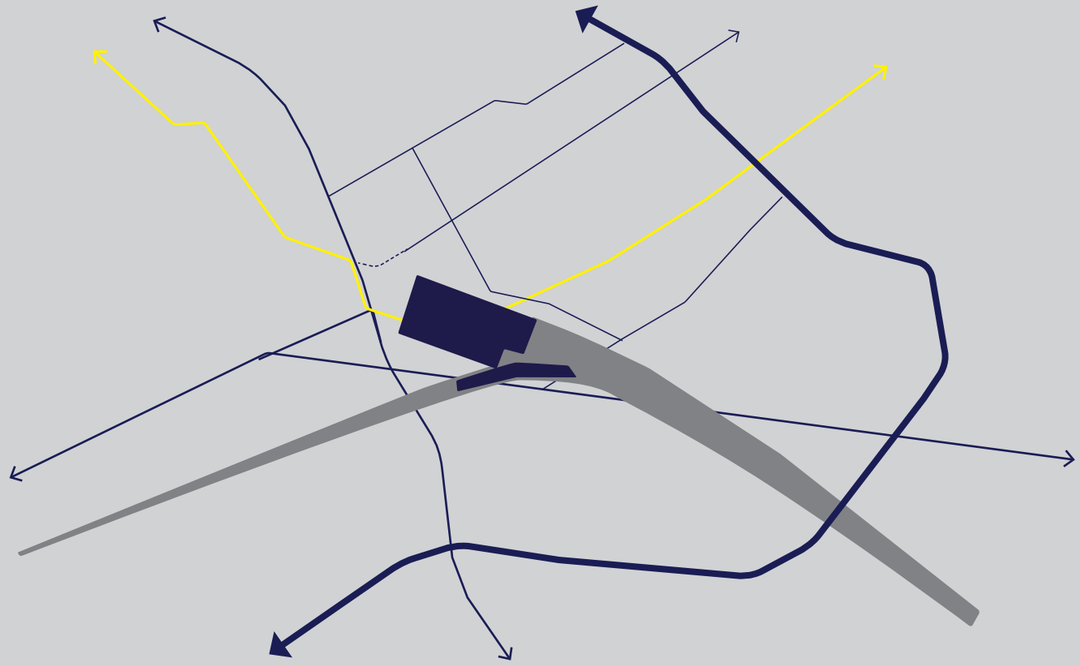

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Executive Summary

Background

Manchester has seen a growth in rail use of 66% in the past ten years. Forecasts predict growth to continue. A series of rail developments are proposed at Manchester Piccadilly, as follows:

- The addition of Platforms 15 and 16 as part of the Northern Hub scheme;
- HS2 Piccadilly Station and connection to the high speed network;
- Northern Powerhouse Rail (NPR) station and onward connections across the north.

The growth of rail use and the proposed rail developments offer a fantastic opportunity for passengers, and the regeneration of Manchester and beyond. With existing and proposed rail schemes coupled to the connectivity of the Metrolink and effective pedestrian, cycle, bus and road connections, Manchester Piccadilly has the potential to become a transportation "Superhub".

Manchester City Council have developed the Piccadilly Strategic Regeneration Framework Area which identifies a Zone of 140 acres around the south and east sides of Piccadilly Station. This area is currently underperforming and still contains many underdeveloped or low value former industrial and commercial sites and is a focus area for the City Council. It contains the sub-area termed Mayfield Development Area which is to the south of Piccadilly Station.

Access to the station in its present form is solely limited to its western end; it suffers from a lack of permeability along its perimeter and across its footprint. Connectivity to both the Piccadilly and Mayfield regeneration areas is restricted. Bold proposals and a boost to permeability for the station have the potential to trigger large scale transformation of these growth areas and beyond. There is the potential for these areas to be one of, if not the best connected location in the north.

Remit

The remit to Arup for this study was to explore the following:

1. Options for reconciliation of Manchester's current station system, Northern Hub, HS2 and NPR;
2. Maximisation of commercial opportunities at the station and maximisation of regeneration in the area around the station;
3. Future proofing of near-term opportunities for HS2 and NPR;
4. Opportunities for accelerated delivery.

The work has been undertaken between January and February 2016.

Stakeholder Engagement

We have engaged with stakeholder representatives throughout the process with regular engagement with both the NIC and Network Rail. In order to engage further with the relevant stakeholders a workshop outlining and discussing the findings as set out in this report was held. This involved the NIC, Network Rail, Transport for the North (TfN), Transport for Greater Manchester (TfGM), HS2 Ltd, the Department for Transport and Merseytravel. This has been supplemented by further meetings with Manchester City Council, Department for Transport and TfGM.

Proposed Developments

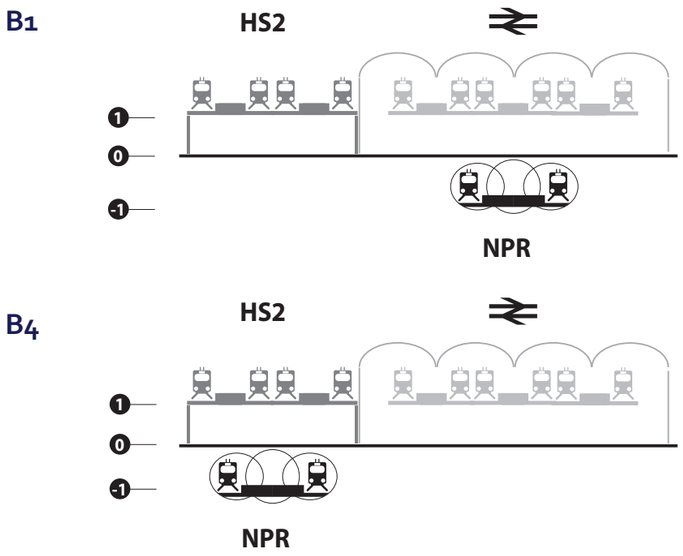
Of the three proposed station developments at Manchester Piccadilly, both the platform 15 and 16 package, and HS2 are reasonably well defined. However, the potential NPR solution is still in development. The addition of Platforms 15 and 16 at Piccadilly will provide a vital improvement along the congested Piccadilly to Oxford Road Corridor; providing an increase in train frequency from 12 to 16 trains per hour, longer services and the enabling of overtaking of different train services. These works are currently proposed in CP6 (2019-2024). There is also potential resignalling work proposed at Piccadilly Station

To inform our station reconciliation strategy, we have undertaken an assessment of potential NPR station box locations. A series of options were developed for the potential location of NPR platforms. These were grouped along three broad concepts:
Concept A – NPR platforms are at or above ground. No change to HS2 routing;
Concept B – NPR platforms are below ground. No change to HS2 routing;
Concept C – NPR and HS2 platforms are located below ground. This concept has been introduced in order to appraise the potential options for a realigned and repositioned HS2 route in light of the adjustment to the context of potentially conveying NPR services.

Each option has been assessed against the following criteria:

- City Gateway - how well the proposal would enable or disadvantage the delivery of a station as a transformational entrance to the city;
- Urban Centre – how well the proposal would enable or hinder connection with the city;
- Passenger Experience - an assessment of whether the platform arrangement would aid or hinder the movement of passengers and the potential passenger experience of using the station space;
- Connectivity – the effectiveness that the option delivers for NPR routing, interconnection with other transportation elements;
- Costs – a qualitative assessment of a the relative costs of options;
- Development Potential – how well the proposal would enable or hinder the development / regeneration potential of the area;
- Environment – consideration of the relative environmental impact between options;
- Programme – qualitative assessment of the potential impact on the current delivery programme for HS2. A change to the consulted route would require a re-consultation and a delay to its programme.

Following the options sift, two Concept B station box options (Options B1 and B4 which position the NPR station below ground) have been reconciled with the other elements of Piccadilly Station to form a fully integrated station.



The Metrolink would be positioned centrally to the classic rail infrastructure, HS2 and NPR to maximise interchange efficiencies during the intermediate and ultimate stages.

Maximising Commercial Opportunity and Maximising Regeneration around the Station

The ultimate station concept was developed with a focus towards its delivery in a phased approach to maximise early benefit while seeking to minimise disruption to operations and the public. This first phase describes those works which can, and ideally would, be undertaken within the short-term prior to delivery of HS2.

Executive Summary

Station Proposals – Phase 1 (pre-2026)

1. Opening the station undercroft to public use for retail and circulation
2. Moving the Metrolink route to the north of the station
3. Closure of Fairfield Street between London Road and Travis Street
4. Potential relocation of the existing Chorlton Street coach station to the south of the station
5. Either repositioning or relocation of taxi and drop off facilities either within the new coach station or to the north of the station
6. Moving of the car parking spaces in the undercroft to adjacent available locations for parking
7. Introduction of Platforms 15 and 16 to the south for improved through rail movements
8. Preparation for HS2

The Network Rail platforms 1 to 12 are proposed to stay unaltered to minimise disruption to train operations at Piccadilly station. However better connectivity and passenger experience will be achieved through connectivity into the undercroft area. The permeability that the undercroft would enable will strengthen the interchanges in between Network Rail and the other major transport services.

Whilst all these works in Phase 1 are enablers to the wider regeneration of the Piccadilly Area. The timely completion of the Northern Hub Platforms 15 & 16 works are crucial to the delivery of the Mayfield site regeneration.

The delivery of Platforms 15 and 16 earlier than currently proposed will achieve the following critical elements:

- delivery of additional train capacity to service the Mayfield development
- avoidance of significant disruption to the Mayfield side of the station
- provision of a new station entrance to that side.

Overall, the early delivery will help to accelerate the regeneration of Mayfield and realise the commercial benefits sooner. To avoid subsequent disruption, any further proposed resignalling should be brought forward to be completed concurrently with the delivery of Platforms 15 and 16.

Station Proposals – Phase 2

There is the potential to build the NPR station box in this phase if it is decided to place it under the proposed HS2 station.

HS2 Phase 2 is programmed to commence full operation to Manchester Piccadilly in 2033. There is an aspiration that the HS2 station at Piccadilly is delivered by 2026 to provide the catalyst for regeneration alongside and for the potential population of the commercial opportunities within the station. There may also be an opportunity for it to be temporarily connected to the classic network in order to relieve capacity issues at the classic platforms of Piccadilly; however, this would require further study to assess the economic viability of this short-term measure.

Phase 2 consists of:
1. Construction of the HS2 station
2. Relocation of the taxi and drop off facilities north along HS2 station
3. Integration with retail and cross movements under HS2 station

Station Proposals – Phase 3

The completion of the NPR station at Manchester Piccadilly will be the last step of the process of transforming the station in to a transport super hub.

The NPR station is proposed to stay underground on its way to east as it passes through Manchester city. This enables location and orientation alternatives. Staying under the existing Piccadilly station or positioning NPR under the HS2 station box will maximise interchange efficiencies and travel distances.

Future Proofing Near-term Solutions

With major infrastructure additions to the Manchester Piccadilly Station and its context, it is essential to co-ordinate the timing of these large scale schemes and their construction stages. A major objective would be to avoid and mitigate any disruption to the existing services and their operations and maximise the leverage in the wider area regeneration.

Station Asset Value

As the station vision is put in place to satisfy the aspects of seamless journeys and interchanges, place making and urban connectivity and integration; stations asset value will increase significantly. This is amplified through the transformation of the station will bring together retail opportunities (shopping, food and beverage) that are spread across a floor plate of approximately 20.000sqm under Network Rail and HS2 stations including circulation space. This is a substantial space comparable to the ground floor retail of St. Pancras.

The timing of the transport and regeneration schemes will be of high importance so that the investment can go ahead with the knowledge of and with reference to their adjoining and contemporary developments. The movements in and out of the station will enhance urban links and developments around the station will need to address to the place making qualities and physical and spatial response to the user activities.
The creation of this exemplary destination environment for passengers, public and station operators and their staff would turn the station in to an ideal urban space to come back to for travel, for retail or a destination for leisure as well as work.

1 Introduction

Introduction

Arup was appointed by the National Infrastructure Commission (NIC) in December 2015 to undertake this study. The remit for Arup was to explore the following:

1. Options for reconciliation of Manchester's current station system, Northern Hub, HS2 and NPR;
2. Maximisation of commercial opportunities at the station and maximisation of regeneration in the area around the station;
3. Future proofing of near-term opportunities for HS2 & NPR;
4. Opportunities for accelerated delivery.

The work has been undertaken between January and February 2016.
We have engaged with stakeholder representatives throughout the process with regular engagement with both the NIC and Network Rail. In order to engage further with the relevant stakeholders a workshop outlining and discussing the findings as set out in this report was held. This involved the NIC, Network Rail, Transport for the North (TfN), Transport for Greater Manchester (TfGM), HS2 Ltd, the Department for Transport and Merseytravel. This has been supplemented by meetings with Manchester City Council, Department for Transport and TfGM.

1.1 Proposed Rail Developments

The reconciliation of Manchester's current station system is in the context of several proposed developments that will need to be integrated across Manchester in the next 20 years [illustrated in the figure opposite], including:

Platforms 15 and 16

Two additional platforms are proposed on the southern side of the station; creating an expansion alongside the existing annex platforms 13 and 14 (currently the only 'through' platforms). This scheme was developed as part of Network Rail's Northern Hub programme. It includes the expansion of the existing platform 13 and 14 concourse.

There is also a linked scheme for the remodelling of Oxford Road station to enable longer and more frequent trains along the Piccadilly to Oxford Road corridor.
Both these scheme are presently the subject of a Transport and Works Act Order and are currently proposed for delivery during the CP6 period (2019 to 2024).

The completion of these schemes provide a vital improvement along the congested Piccadilly to Oxford Road Corridor; providing an increase in train frequency from 12 to 16 trains per hour, longer services and the enabling of overtaking of different train services. The schemes were designed to relieve the exceedance of present capacity up to the early 2020s.

HS2 Piccadilly Station

A new, four platform, terminus station is proposed in Manchester as part of HS2 Phase 2. The station is proposed on the north side of the current Network Rail Piccadilly Station with the tracks on a viaduct at a similar level to the existing classic rail lines within the existing Piccadilly Station sheds. The route enters Manchester centre from Manchester Airport within a tunnel. The tunnel portal is southeast of Manchester Piccadilly.

The proposed alignment of HS2 into Manchester has been published for public consultation by HS2 Ltd. The Piccadilly Strategic Regeneration Framework (produced for Manchester City Council) locates the new HS2 station further west towards London Road to capitalise on the commercial benefits of this location closer to the city. These two potential locations are indicated on the adjacent page. This study has been undertaken on the basis of the location indicated in the Piccadilly Strategic Regeneration Framework.

HS2 Phase 2 is programmed to commence full operation to Manchester Piccadilly in 2033. There is an aspiration that the HS2 station at Piccadilly is delivered by 2026 and temporarily connected to the classic network in order to relieve capacity issues at the classic platforms of Piccadilly.

Northern Powerhouse Rail (NPR)

The NPR concept is being developed by TfN. Studies by TfN indicate that the required level of service cannot be accommodated through the existing routes nor stations. Therefore, consideration of additional corridors and stations is underway. The two relevant parts for this study are the route between Liverpool and Manchester Airport / Manchester and the route between Manchester and Leeds/Sheffield. At present there are no firm proposals; a business case is being developed by TfN.

TfN propose that the NPR route from Liverpool / Manchester Airport to Manchester utilises the HS2 alignment. This is considered to be the optimum way of providing trans-north connectivity to Manchester Airport via NPR. We understand that HS2 has assessed an alternative stopping pattern which frees up a degree of capacity for NPR on the HS2 link into Manchester Piccadilly. However, it is vital that the available capacity for the NPR services running on the HS2 route is fully assessed to ensure its ability to carry the proposed NPR and HS2 services and any future growth projections (outside the bounds of this study). The inclusion of NPR services on the HS2 route into Manchester offers an opportunity to maximise the utilisation of this proposed infrastructure. Through considered planning of the requirements of each service an overall most cost-effective solution for the country may be found.

TfN and Network Rail are presently undertaking studies to evaluate route solutions between Manchester and Leeds / Sheffield. The existing routes considered in these studies are the Calder Valley route, the Diggle route and the Hope Valley route. A potential new rail corridor is being considered which is termed the Central Corridor which heads east from Manchester to join HS2 to the east and enable north and south passage via HS2 to Leeds and Sheffield.

1.2 Our Approach

Section 2 and 3 of this report describe the necessary context which underpins the remit. Section 4 addresses each specific element of the remit. The content of each of these is as follows:

- **Section 2** describes the benefits that a well considered and designed station can deliver for regeneration and how that can be best realised. It also explains the regeneration context around Piccadilly Station thereby informing the Piccadilly Station strategy described in the subsequent sections;

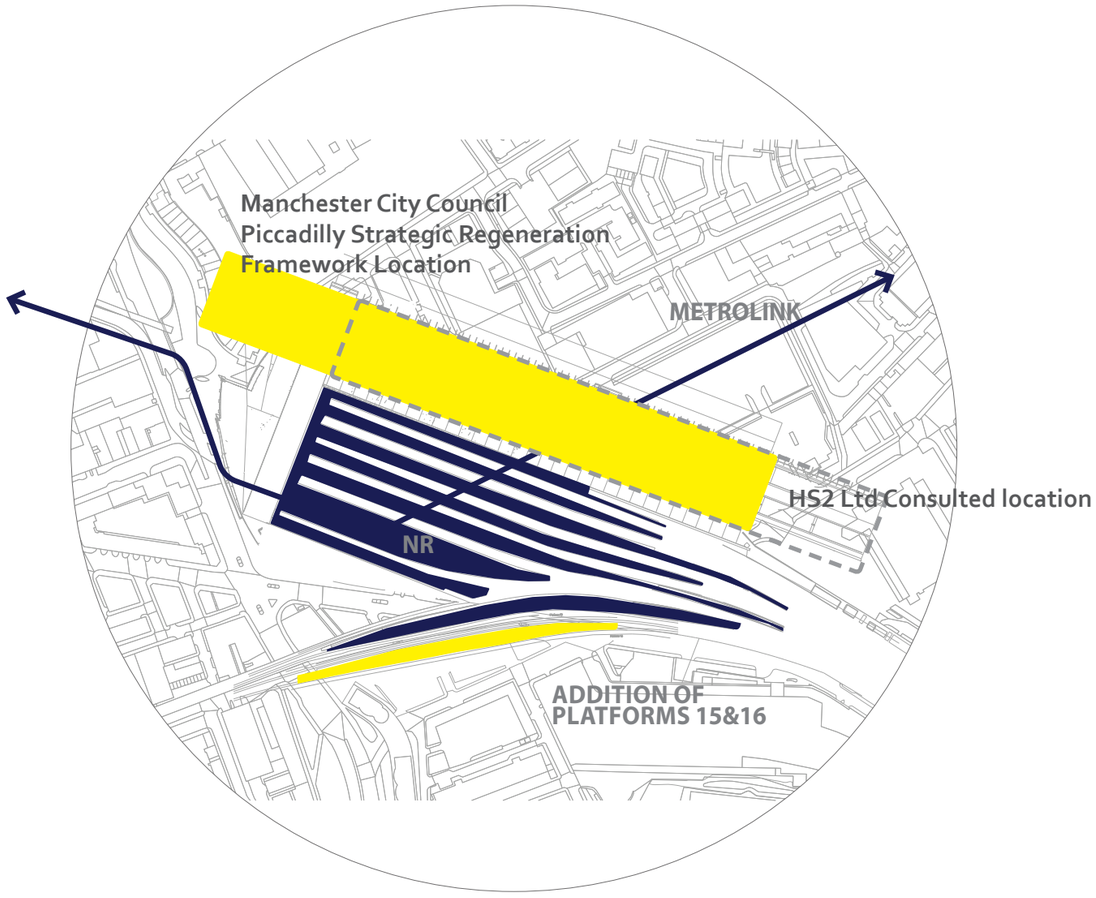
- **Section 3** details our approach taken to evaluate potential NPR platform locations. Of the three proposed developments at Manchester Piccadilly noted in Section 1.1, both the platform 15&16 package and HS2 are reasonably well defined. However, the potential NPR solution is still in development. Therefore, to inform our station reconciliation strategy, we have undertaken an assessment of potential station box locations. Section 3 describes the work undertaken by Arup;

- **Section 4** outlines our station proposals for Piccadilly. It also specifically addresses each element of the remit:

  - Reconciliation of the proposed rail developments into an effective single station;
  - Maximisation of the commercial opportunities at the station and of the station's positive impact to regeneration in the area around the station;
  - How early delivered schemes may be future proofed for the subsequent schemes;
  - Opportunities for accelerated delivery.

Introduction

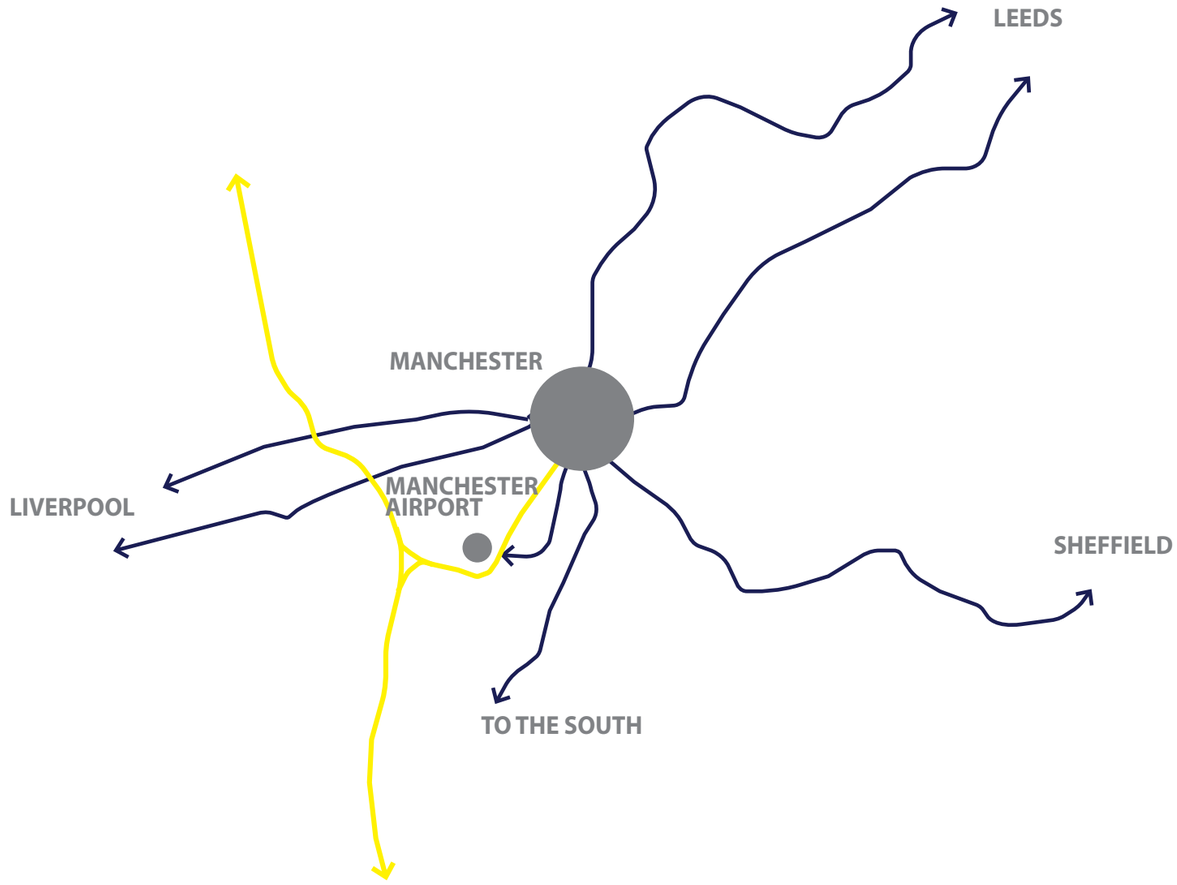
Proposed Rail Developments



Existing rail / Tram infrastructure

Proposed rail developments

Schematic map showing rail connectivity across the northwest



Existing classic rail route

Proposed HS2 routes

Regeneration

2

Regeneration

2.1 Regeneration Context

Effectively designed transport interchanges can mobilize significant increases in development and regeneration value, as has recently been demonstrated with the improvements to London King's Cross and Birmingham New Street stations and the impact they have had on regeneration around them.

King's Cross regeneration

2.2 The Manchester Piccadilly Opportunity

Through effective, early planning and design the proposed additions of HS2 and Northern Powerhouse Rail to the existing Manchester Piccadilly station have the potential to trigger the large scale transformation of Manchester's Piccadilly district.

Manchester City Council have developed the Piccadilly Strategic Regeneration Framework Area which identifies a Zone of 140 acres around the south and east sides of Piccadilly Station. This area is currently underperforming and still contains many underdeveloped or low value former industrial and commercial sites and is a focus area for the City Council. It contains the sub-area termed Mayfield Development Area which is to the south of Piccadilly Station.

The regeneration framework identifies the proposed HS2 station located further west towards the City Centre in order to maximise the commercial opportunity associated with the station. It also identifies the removal of the existing Gateway House (on Station Approach) in order to enable this positioning of the HS2 station and achieve improved regeneration benefits.

There also exists a third area with the potential for regeneration in the vicinity of Piccadilly Station which covers the University of Manchester Sackville Street Campus, described below. All three of these areas are illustrated on the subsequent page.

2.3 Piccadilly Regeneration Area

The Piccadilly Strategic Regeneration Framework area (northeast of Piccadilly Station) anticipates the delivery of the following:

- 4,500 new homes;
- 625,000 sq m of commercial office space;
- 100,000 sq m of retail space and 1,000 new hotel rooms;
- The creation of numerous high quality public spaces and a string of cultural and community use buildings.

The arrival of HS2 into Manchester is seen as a catalyst for the regeneration of this area. At present, connection from Piccadilly Station to this area is very poor with no direct access. Current plans assume the HS2 alterations to the station will enhance the existing entrance and extend its 'destination' impact further north and east.

All of the options considered herein allow for an enhanced station entrance experience. However, the major impact on this area to the northeast is likely to be driven by the catalytic effect the transformation of the station experience itself can have. A grand new entrance alone may not have the effect of spreading the 'enhanced image' effect further east, without a significant change in the retail, food and beverage offer of the station. Greatly improved station permeability from the east will also be a vital element of maximizing the regeneration potential of this area.

2.4 Mayfield Development Area

The Mayfield area (south of Piccadilly Station) is being progressed by the Mayfield Partnership Limited (Manchester City Council, London and Continental Railways and TfGM). The scheme is expected to deliver over 10 years with the first phase of offices capable of being ready for occupation in 2020 in anticipation of a significant government requirement.

The completed development will provide for the remediation of the River Medlock as a centrepiece of a new 6 acre city park. The scheme as a whole will deliver:

- 24 acres overall;
- Circa 100,000 sq m of commercial/office space;
- Over 1,500 residential units.

Connection from Piccadilly Station to this area at present is limited with access gained from the entrance at the corner of London Road and Fairfield Street. Fairfield Street also poses a barrier to the easy movement of pedestrians from Piccadilly Station to the Mayfield area.

The introduction of a new entrance to the station directly from the site, improving overall station permeability and the site's proximity to the new through rail services will help establish development values and regeneration potential. The timing of the delivery of the proposed Platforms 15 and 16 and works to the south side of Piccadilly will be vital to realise the full benefits early. In particular, the delivery of Platforms 15 and 16 earlier than currently proposed will achieve the following critical elements:

- delivery of additional train capacity to service the Mayfield development
- avoidance of significant disruption to the Mayfield side of the station
- provision of a new station entrance to that side.

Overall, the early delivery will help to accelerate the regeneration of Mayfield and realise the commercial benefits sooner. To avoid subsequent disruption, any further proposed resignalling should be brought forward to be completed concurrently with the delivery of Platforms 15 and 16.

As this site is already considered a priority by Manchester City Council it is important that the options for expansion of the station do not preclude these plans progressing at the earliest opportunity. Therefore, blocking the development of the Northern Powerhouse lines and platforms on this side of the station.

2.5 University of Manchester Sackville Street Campus

Faculties within this campus are being relocated to a new facility closer to the existing campus on the Oxford Road corridor. A number of the buildings have been put forward for sale to developers and more are likely to follow.

This area is reasonably well connected to Piccadilly Station via Fairfield Street. However, Fairfield Street itself and London Road do form a barrier for free pedestrian movement. If this area is to benefit from the station's transformation it will need careful masterplanning to ensure pedestrian routes through and to it are well aligned with station entrances. The footfall from rail passengers may not be sufficient alone to trigger significant development activity and is unlikely to support increased 'dwell' time for passers through. For this reason, the transformation of the station into a 'destination experience'- another place to visit in the city centre - will help pull city centre visitors through the site and add significant vitality to it over longer periods of the day/weekend.

Regeneration

Manchester City Council Piccadilly Strategic Regeneration Framework - Produced by Bennetts Associates

2.6 Realising Regeneration Benefits

2.6.1. Over-Site Development

The most immediate means of realising regeneration through the development of air-rights above the station and as part of the core station box. Birmingham New Street's redevelopment has created new development opportunities above and immediately adjacent to the station.

At Piccadilly our options study has suggested a more immediate opportunity to open up the space beneath the station for retail, food and beverage use. Through the removal of the tram station (relocating the tram route to the north) and the removal of parking and some servicing in the archways beneath there is the potential to create a new space beneath the current platforms. By integrating the space below existing and new planned platforms it may be possible to create a new concourse and 'destination experience' whilst also linking the site through to its surroundings on the north and south at ground level. This would greatly enhance the potential of the Mayfield development and has the potential to open up new opportunities for development in the northeast.

2.6.2 Station Permeability

There are presently very few station entrances proposed and the assumption is that the current main entrance to the station will be enhanced to be the 'image' transforming anchor for the area.

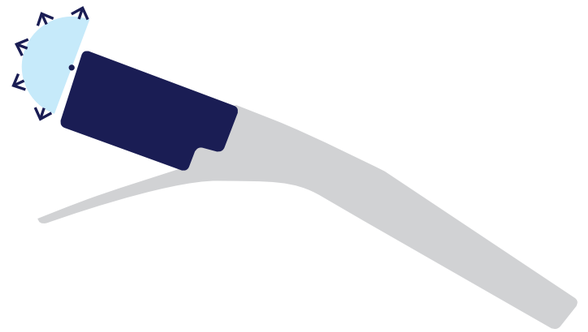
However, with the developments to the south and east of the station and the accommodation of HS2 to the north of the existing station it is important that the opportunities to increase the permeability of the station are considered. The length of the HS2 platforms mean that it is perfectly possible to create new entrances on the north eastern side of the station connected into HS2 platforms and possible Northern Powerhouse platforms and linking though to the main concourse. **In creating such routes there is the scope to open up north-south and east-west movement though the station enhancing it as a 'destination' from all parts of the city. Creating new entrances to the north and east would also help spread the regeneration of the City Centre beyond the 'boundary' currently created by the station, linking it to Ancoats and beyond.**
The principle of additional entrances could complement and not undermine the idea of a main anchor entrance or the new entrances to the south. It may also dramatically increase the development and regeneration potential of the station investment.

2.6.3. Station Entrance Orientated Development

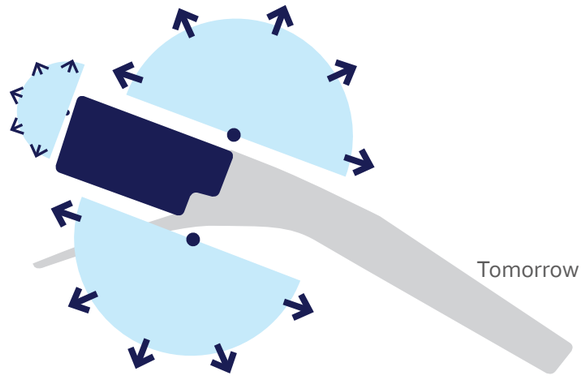
The positioning of station entrances in relation to nearby housing, retail and commercial development can significantly increase development value. Value drops off the further from the entrance development is located, but it can be maintained at higher levels through clever design of routes to the entrances. In Japan and Hong Kong new station entrances are deliberately positioned to spread development value and raise capital for railway companies. Shinjuku station in Tokyo has over 200 entrances, many of which attract premium commercial rental values.

2.6.4. Enhanced Image and Transformed Station Experience

The transformation of stations from historic concourse and platform designs to 'destination' experiences can create new value both inside and outside the station. A positive station image can have a significant effect on the desirability of a neighborhood. The transformation of King's Cross and St Pancras stations into new 'destination's for London (characterized more by the retail, food and beverage offers than platforms and train services) has been a major contributor to the renewed attractiveness of this district of London. This year it has achieved the highest commercial rental values in London.



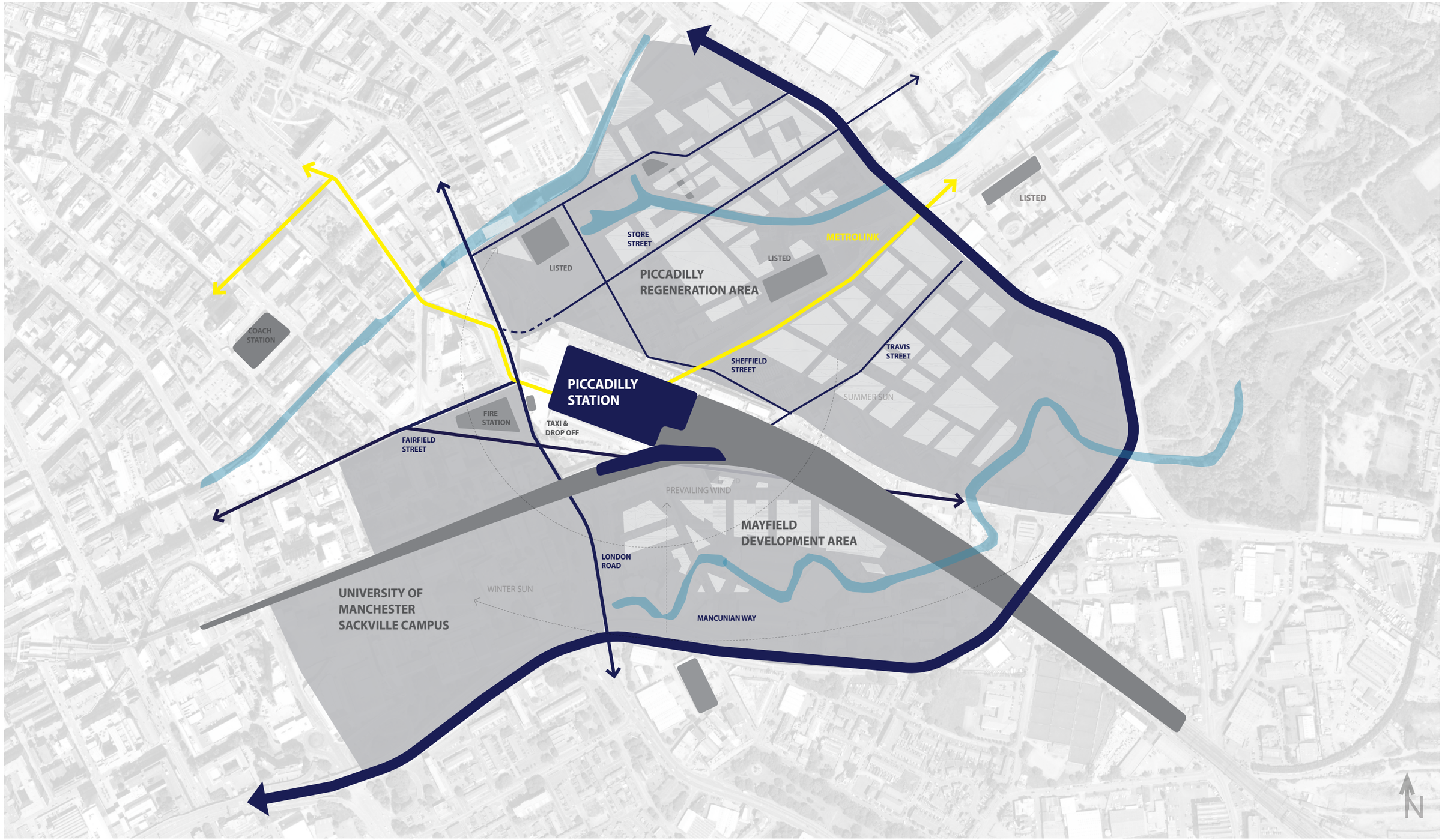
Today



Today / Tomorrow

Regeneration

The proposed regeneration areas encircling Piccadilly Station from the southwest to northeast



NPR Station Options 3

NPR Station Options

The incorporation of any potential NPR stop at Manchester Piccadilly forms a key element in the consideration of reconciliation options at the station. At the present time there are no firm proposals for the routing and station locations for NPR. Therefore, as part of this study, Arup has assessed potential outline options for the positioning and orientation of the potential NPR platforms.

This section describes the outcome of this high level option development and sifting exercise completed by Arup within the timescales of this project. It should be noted that this option development and sifting exercise doesn't represent an exhaustive assessment; it has been undertaken to rapidly indicate potential likely NPR station location options. The options developed and sifted are provided in the accompanying technical appendix to this report; a summary and the outcome is included below.

The development of the options has been based on the design parameter given to Arup that NPR trains between Liverpool and Manchester will utilise HS2 infrastructure. This places Manchester Airport on the NPR route. HS2 Ltd has developed alternative HS2 stopping patterns which enables capacity to be freed for use by NPR. It should be noted that Arup's remit for this current study does not cover consideration of available capacity and stopping patterns rather its focus is on the infrastructure needs to interconnect the transportation elements. If sufficient capacity was available then it may also be possible to extend the connectivity from NPR via HS2 to the north and south.

3.1 NPR Station Box Size

The NPR station box size is predominantly determined by the proposed train length, number of platforms and the platform arrangement. The train length has been assumed as 200m long; this is based on a single unit train length of HS2.

The number of platforms required is a function of the train frequency, dwell time, whether the platforms are 'through' or 'turn back' and any required resilience through addition of extra platforms.

Aspirations for train frequency between the cities across the north are defined in TfN's Conditional Outputs. The figure below indicates these Conditional Output target frequencies (in trains per hour in each direction) into/out of Manchester.

This study has been developed on the basis of six through trains in each direction. The remainder of the target frequency would be provided via the classic network.

A high level assessment undertaken by us indicates that two through platforms would be capable of handling this train frequency, where 'through' platforms can be provided. This is based on a 3 minute dwell time and a 3 minute headway between trains. This assessment also indicates that four platforms would be required where an 'in and back out' platform was necessary.

Additional platforms could be added to aid the resilience of the network at the station. However, as reference, the recent Thameslink scheme and Crossrail are being delivered with two through platforms; Thameslink is designed for 24 trains per hour in each direction. Therefore, for the purposes of this study, where a 'through' NPR platform can be achieved two platforms would appear to be a reasonable assumption.

If the frequency indicated in the diagram above was to be provided on NPR alone it would mean six through services and six turn-back services at Manchester. A high level assessment indicates that this would require two through platforms and four turn-back platforms. This would appear to be in excess of a reasonable platform provision when considered in the presence of the classic rail services across these routes.

Track crossovers should be provided on the approach / exit to the NPR platforms in order to provide a degree of flexibility and resilience at a two platform through station and also essential to allow all platforms to be used in the case of an 'in and back out' station. These are described in more detail in the technical appendix.

3.2 NPR Station Box Location Options

A series of options were developed for the potential location of NPR platforms.

These were grouped along three broad concepts:

Concept A – NPR platforms are at or above ground. No change to HS2 routing;

Concept B – NPR platforms are below ground. No change to HS2 routing;

Concept C – NPR and HS2 platforms are located below ground. This concept has been introduced in order to appraise the potential options for a realigned and repositioned HS2 route in light of the adjustment to the context of potentially conveying NPR services.

Any scheme with below ground platforms will necessitate the rolling stock being designed for the appropriate fire risk.

A set of criteria was proposed in order to assess the options at high level and in line with design objectives. This led to the understanding of two different kinds of assessment criteria that are applicable and required for the specific scope of this assignment. One set of criteria enabled the design team to assess the technical, quantifiable and monetary aspects of the design, these are indicated in blue in the below diagram. The second set of criteria enabled the assessment of other aspects of the design proposals that are less easily quantified and relate to public and passenger experience, convenience and the urban and sociocultural presence of the station in the local context, the city and ultimately globally. These are indicated in red in the below diagram.

Each option has been assessed against the following criteria:

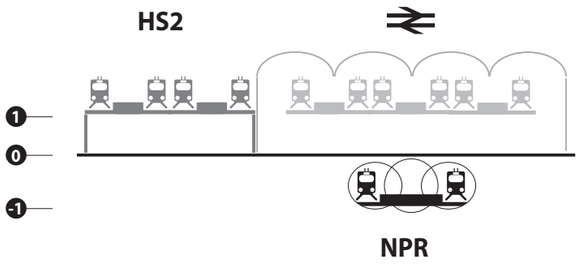
- City Gateway - how well the proposal would enable or disadvantage the delivery of a station as a transformational entrance to the city;
- Urban Centre – how well the proposal would enable or hinder connection with the city;
- Passenger Experience - an assessment of whether the platform arrangement would aid or hinder the movement of passengers and the potential passenger experience of using the station space.
- Connectivity – the effectiveness that the option delivers for NPR routing, interconnection with other transportation elements;
- Costs – a qualitative assessment of a the relative costs of options;
- Development Potential – how well the proposal would enable or hinder the development / regeneration potential of the area;
- Environment – consideration of the relative environmental impact between options;
- Programme – qualitative assessment of the potential impact on the current delivery programme for HS2. A change to the consulted route would require a re-consultation and a delay to its programme.

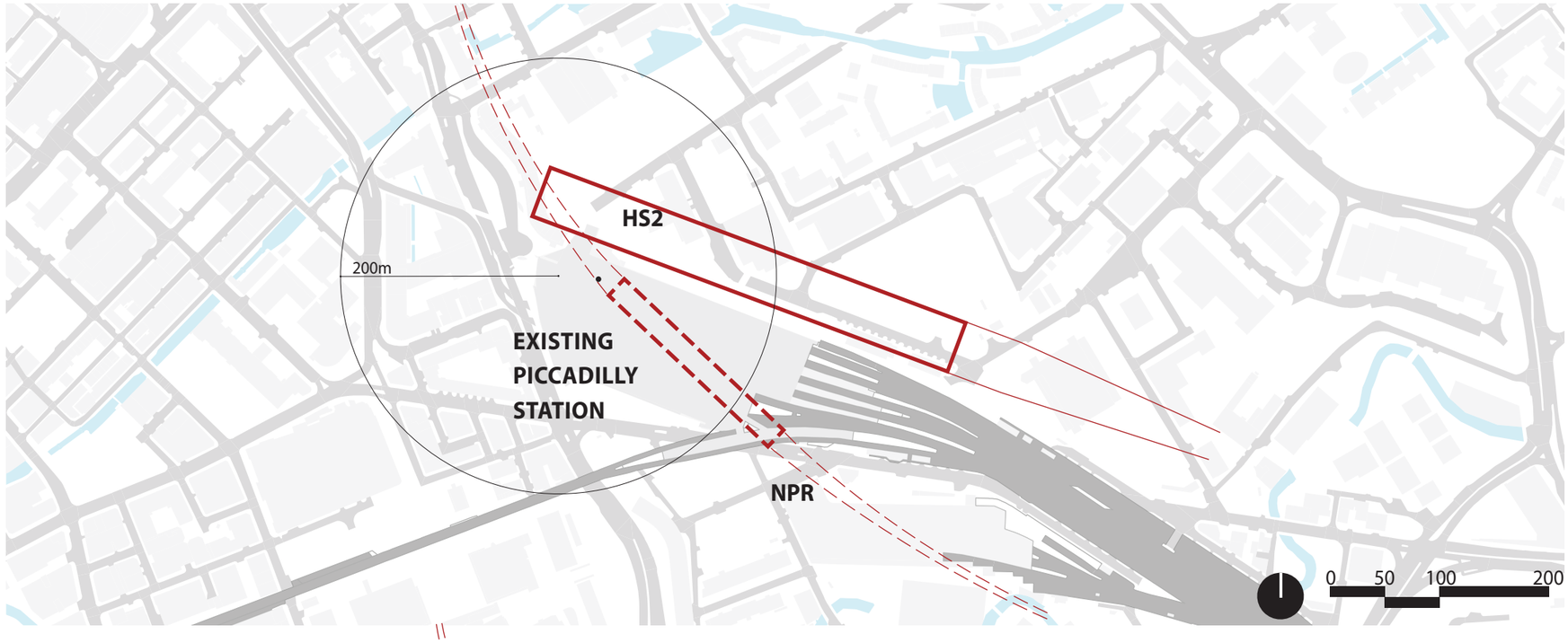
Following the options sift, two Concept B station box options (Options B1 and B4) have been taken forward to consider their reconciliation with the other elements of Piccadilly Station.

NPR Station Options

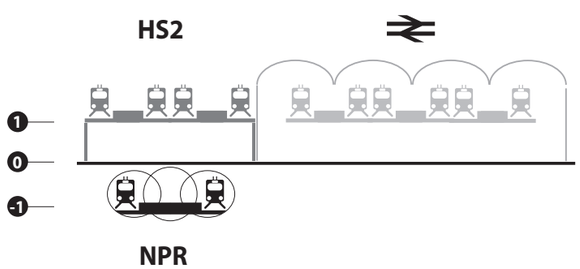
Conceptual location plans indicating the potential positioning of the NPR platforms below Piccadilly

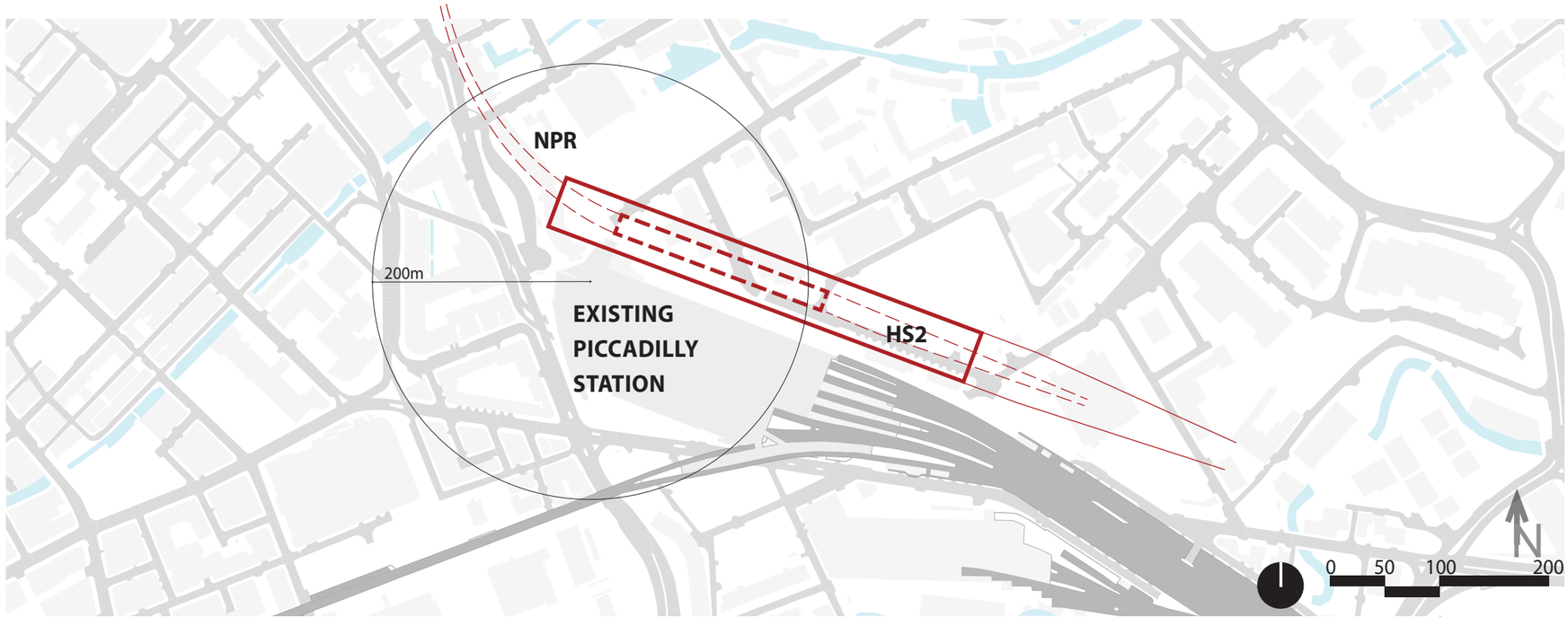
B1





B4





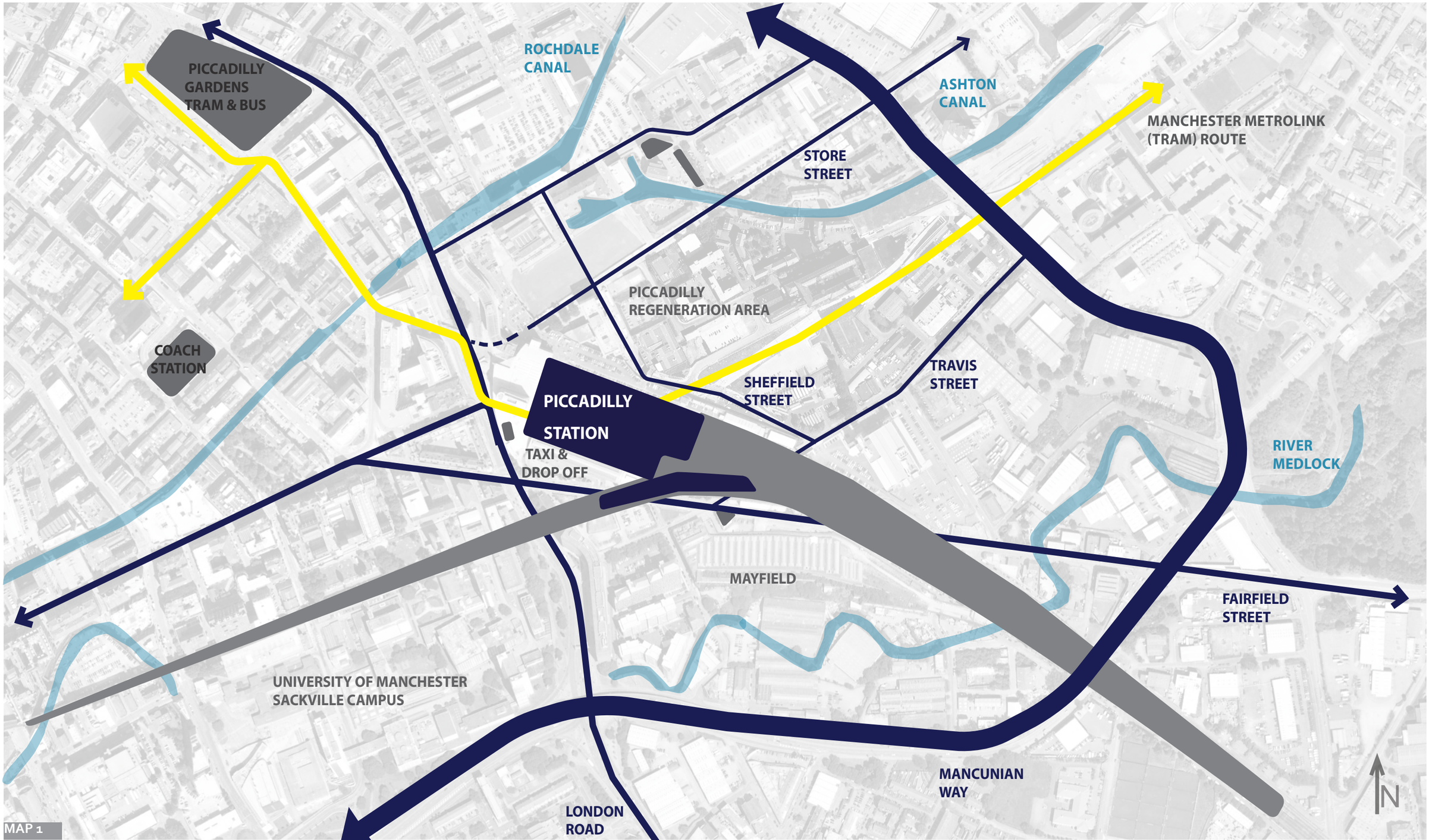
Piccadilly Station

4

Piccadilly Station

Piccadilly Station

Manchester Piccadilly Station Context



MAP 1

Piccadilly Station

4.1 The Existing Station

Manchester Piccadilly is the principal railway station in Manchester. The listed train shed roof which is 105 metres wide between platforms 1 and 12, has four spans, two spans 185 metres in length over the eastern part of the station date from the 1860s while the other two at the western side measuring 150 metres long were built in the early 1880s. All current platforms at the station are located on viaducts above the adjacent ground level. The station concourse is located at the western end [Image 1]

The east and west main walls of the station sheds represent the history of the station and each rests on a cast iron structure from ground level [Image 2]. The main entrance via the station concourse is surrounded by the nearby buildings on and across London road and a ramped approach takes the passenger and public movements to the concourse level of +49.4 m.

The front (western) end of the station has the unpaid side facilities at concourse level and divided from the paid side platforms by a glazed wall [Image 3]. The concourse area has an upper level mainly composed of retail units.

The terminating platforms vary in size with the widest platform 10-11 approx 23m in width and all platforms in excess of 200m in length. The platforms are connected on the eastern end by a footbridge and sets of escalators or stairs and three platforms are also with lift provision.

The through platforms 13 and 14 are situated on the railway viaduct that is adjacent to the south of the station. The access to the through platforms are via Platform 11 travelators and the interchange deck that connects the main station with these through platforms. [Image 4]

Platforms 15 and 16 are due to be introduced to this side of the station adding further through capacity to the existing railway infrastructure and services. A second viaduct is adjacent to platforms 13 and 14 is proposed.

A relatively less exploited section of the Piccadilly station is the area below the main station sheds which currently houses staff car parking, plant and storage spaces. This "undercroft" area [Image 5] is at approximately the same level as the existing external ground adjacent to the station in the western, southern and eastern directions. Access to this undercroft can presently be gained from Sheffield Street.

The Metrolink (tram) Piccadilly Station stop consists of two platforms located within the undercroft at ground level below the main station sheds. Tram access to / from the stop is gained via London Road to the west and Sheffield Street to the east.

A premium car parking is located directly to the top of the northern lower edge of the station and provides level access to the station concourse from surrounding car park facilities. [Image 7]

The proposed HS2 station with Manchester City Council's Strategic Regeneration Framework is to be located on the northern side of the existing Piccadilly Station with the station extent further west towards London Road, beyond the classic rail sheds. The proposed HS2 station would maintain the same platform levels as the existing classic rail platforms.

Manchester Piccadilly station is surrounded by a network of roads at varying levels and therefore has different levels of legibility and accessibility around its footprint.

London Road slopes down towards the south of the station where the station access ramp rises up to the concourse level. This creates a barrier due to the

Image 1: Existing concourse building and tower

Image 2: Station southern elevation and existing taxi & drop off arrangement

Image 3: Existing station concourse

Piccadilly Station

configuration of the roads at the station periphery at this western end. It is a convoluted route to the south and east sides of the station that lacks legibility and station identity. [Image 8]

The south side of the station facing the Mayfield site, is more prominent with its historic wall and taxi interchange and pick up and drop off areas. The through platforms span across the Fairfield Street creating the triangular interchange space between London Road and the main station building.

Overall the station is lacking permeability along its perimeter and across its footprint. The lack of permeability is worsened by the tram lines cutting through the middle of the undercroft area.

Image 5: Station undercroft and car park useLondon Road South

Image 7: Premiun parking on north of station and extended

Image 4: Platform 10-11 and access to through platfroms

Image 6: Metrolink entry to the undercroft

Image 8: London Road South

Piccadilly Station

4.2 Station Vision

People movements and the space in which this movement occurs are primary aspirations in development of the renewed station concept. The vision is for a single coherent station building and identity to be created. [Image 10, 11]

The station vision is created through the understanding of the current issues of the existing station and its environment. It has been observed that the station is lacking the space making potential that a transport hub of its scale would have to offer. It is defined by the eventual functions that are spread around its perimeter rather than defining its own immediate context.

With the introduction of additional services and networks to Manchester at Piccadilly station this super hub will need to cater for the transport and urban requirements that will be built around it.

An urban axis below viaduct level is proposed to be introduced at the heart of the station that enables movements between the south, east and west, within and from outside of the station; attracting both passengers and public to the station and through to east and south. A Grand Arcade would be created between the classic rail shed and the HS2 viaduct.

The transport structures would define this new urban space and act as a catalyst for the urban regeneration around the station and along the railway corridor.

Our concept is to envelop the HS2 platforms and the Grand Arcade within a single station roof acting as an extension to the existing classic rail train sheds. See the subsequent pages for illustrations of this concept.

The currently non-permeable station undercroft would be opened up and through movements would be attracted with retail inside this generous space of brick arches and vaults.

From the NPR station box optioneering undertaken within this study the two options for NPR platforms place these below ground. The Metrolink would be positioned centrally to the classic rail infrastructure, HS2 and NPR to maximise interchange efficiencies during the intermediate and ultimate stages.

The individual elements forming our concept are described further within the proposed phasing approach in the subsequent pages.

Image 11:
Galleria Umberto: the public shopping gallery of Naples

Image 9: People

Image 10: Space

Image 12:
St. Pancras International station and retail arcade

Piccadilly Station

Station vision for the positioning of transportation modes and the urban axis for pedestrian movement

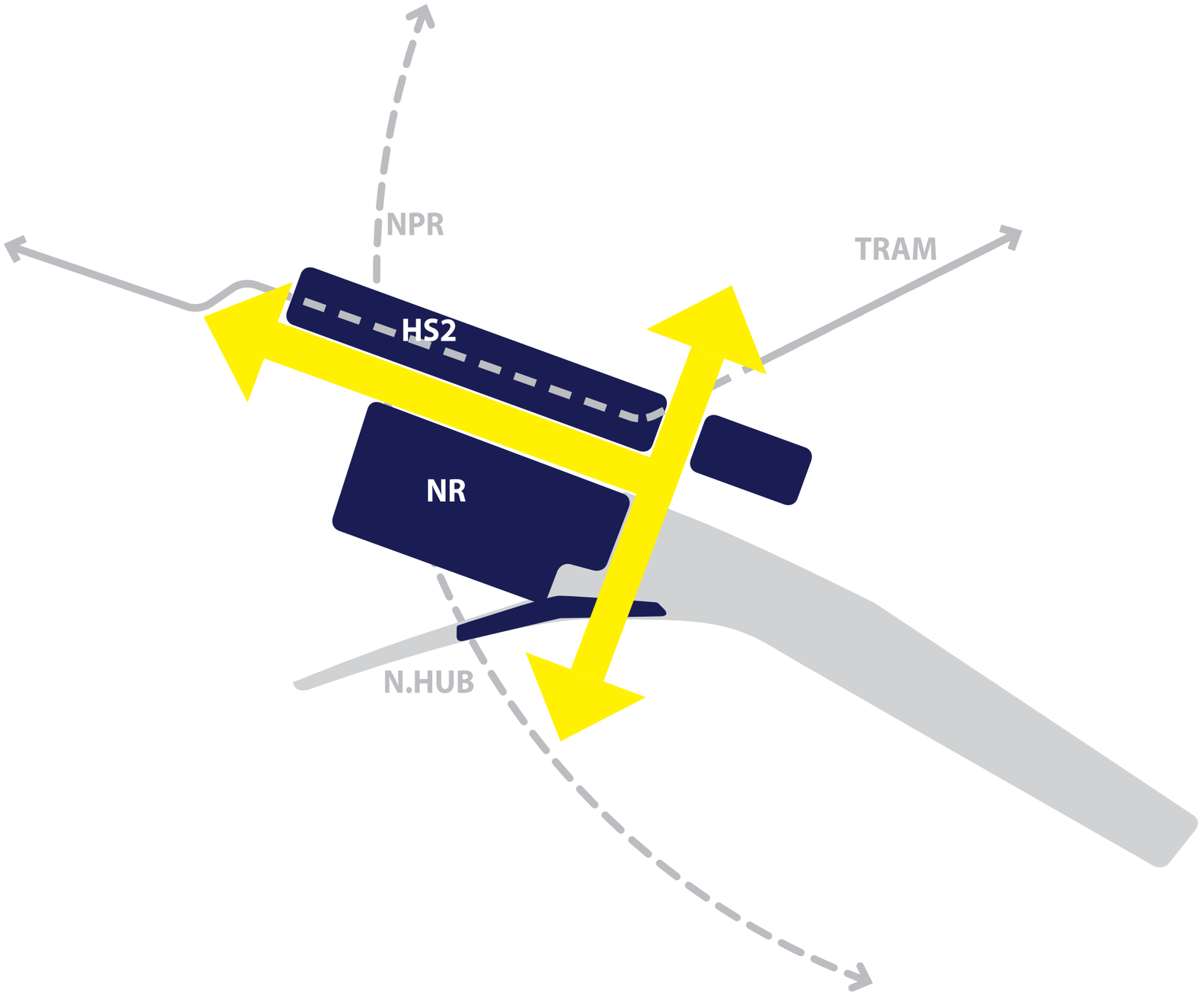
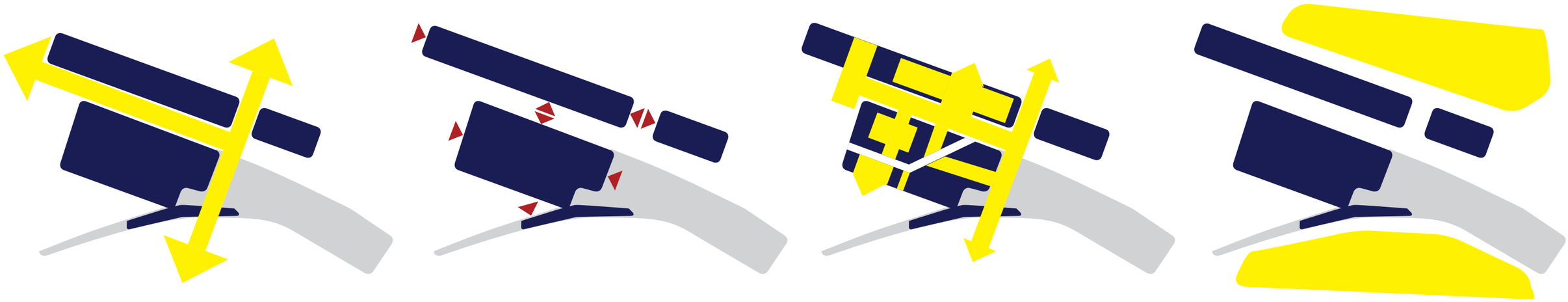


Diagram 1

Piccadilly Station

Station Vision:

The diagrams below illustrate the proposed functionality and interconnection of the proposed station concept



Connect to City:

Improved connectivity to the north and south from the station

Rail:

Improved passenger connectivity to rail

Permeability at ground (undercroft) level:

Improved pedestrian / passenger movement below the rail viaducts and into / out of the station in all directions

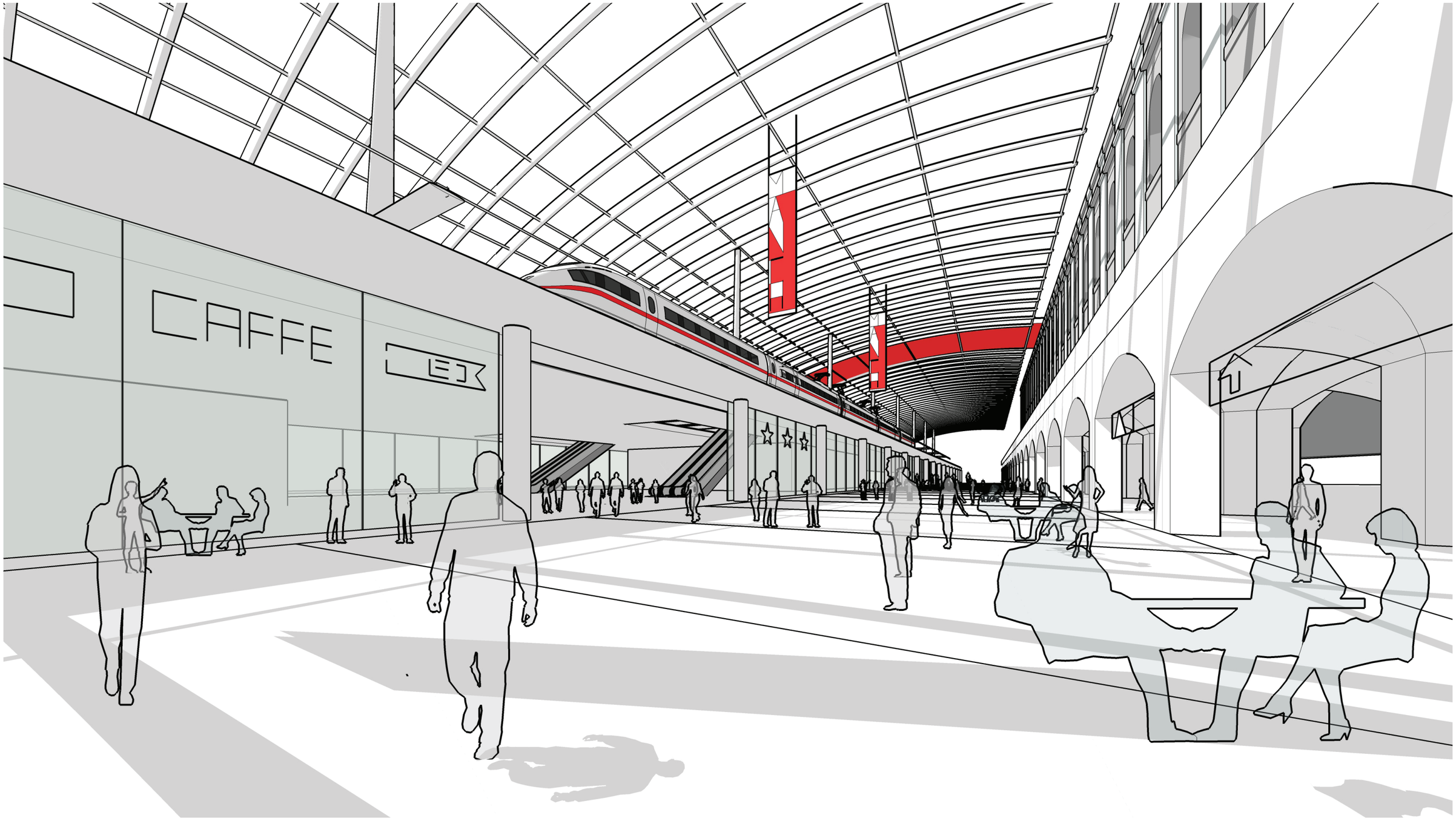
Development Potential:

Improvements to the station resulting in catalysed growth within the nearby regeneration areas

Piccadilly

"Walking in the Grand Arcade" :

Pedestrian level visualisation from the Grand Arcade looking towards the HS2 viaduct. Retail and access provided throughout this level



Piccadilly Station

STATION PHASING - PHASE 1

The ultimate station concept was developed with a focus towards its delivery in a phased approach to maximise early benefit while seeking to minimise disruption to operations and the public. This first phase describes those works which can, and ideally would, be undertaken within the short-term prior to delivery of HS2.

4.3 Station Proposals – Phase 1 (pre-2026)

1. Opening the station undercroft to public use for retail and circulation
2. Moving the Metrolink route to the north of the station
3. Closure of Fairfield Street between London Road and Travis Street
4. Moving the existing Chorlton Street coach station to the south of the station
5. Either repositioning or relocation of taxi and drop off facilities either within the new coach station or to the north of the station
6. Moving of the car parking spaces in the undercroft to adjacent available locations for parking
7. Introduction of Platforms 15 and 16 to the south for improved through rail movements
8. Preparation for HS2

4.3.1 Classic rail – platforms 1 to 12

The Network Rail platforms 1 to 12 are proposed to stay unaltered to minimise disruption to train operations at Piccadilly station. However better connectivity and passenger experience will be achieved through connectivity into the undercroft area. The permeability that the undercroft would then offer will also strengthen the interchanges in between Network Rail and the other major transport services that Piccadilly Station will offer.

The potential that island platform 10 and 11 has with its generous width will need to be further studied with particular consideration to enhance the interchanges with platforms 15 and 16. The proposed station also to enables north south public and vehicular movements under the station and further east. The interfaces with the east end of Network Rail platforms may play a significant role in this scenario with direct connectivity to the station via the north south link.

4.3.2 Classic rail – platforms 13 & 14 + 15 & 16 (Northern Hub works)

With the incorporation of the Northern Hub scheme – currently proposed to be delivered in CP6 (2019 to 2024)- to the south of the station site, there will be higher demand for interchanges and arrivals and departures off this network. The development at Mayfield would add to these movements and a southern station entry point will be vital to enable access to and out of this corner of the station site. The Northern Hub scheme currently proposes the addition of a new viaduct with two through tracks and an island platform. This platform is proposed to be connected to the main station via the existing interchange footbridge that also connects Platforms 13 and 14 to the terminating services.

It must be noted that the early delivery of this scheme is highly preferable to release the current bottleneck in train movements through Manchester and realise this increase in capacity for the rail users.

The physical impact of the existing viaduct for platforms 13 and 14 would be heightened with the addition of the Northern hub platforms. A new viaduct structure will be located adjacent to the existing one [Image 13] and the increased cover is likely to dominate the street level urban space underneath. Enabling free public and passenger movements, encouraging different modes of transport i.e. cycling and public transport through a sympathetically design southern forecourt would increase the attraction of this side of the station and improve the station approach experience.

Image 14

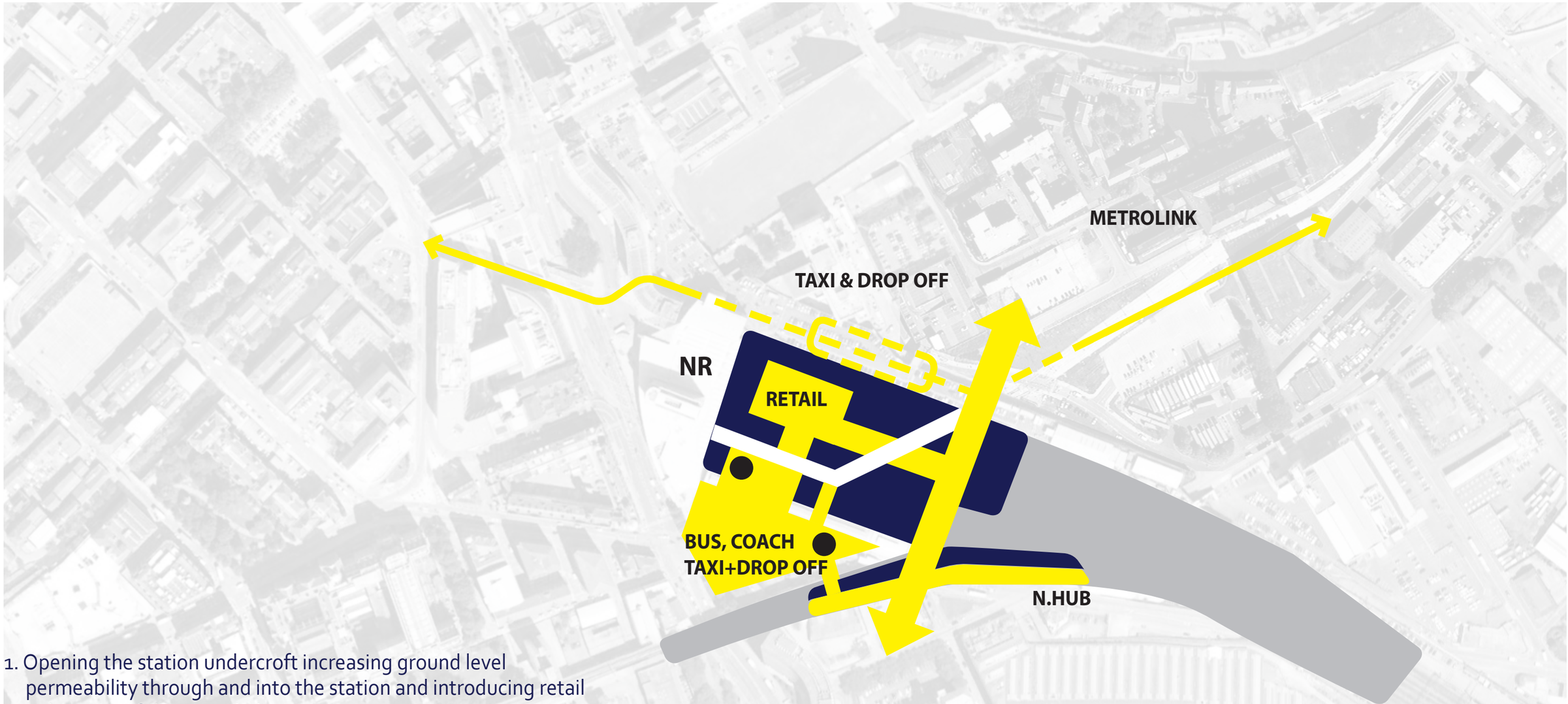
Image 13: The Coal Drops Yard in King's Cross [visual]

Image 15: Kings' Cross St. Pancras shopping arcade

Piccadilly Station

STATION PHASING - PHASE 1:

Ground level plan indicating the delivery of pre-HS2 schemes. Each element has been selected and arranged to maximise early benefit whilst contributing towards the ultimate station concept



1. Opening the station undercroft increasing ground level permeability through and into the station and introducing retail
2. Relocation of the Metrolink
3. Closure of Fairfield Street
4. Potential Relocation of Chorlton Street coach station to Piccadilly Station
5. Repositioning or relocation of the taxi and drop off area
6. Relocation of the current car parking within the undercroft
7. Introduction of platform 15 and 16
8. Preparation for HS2

Piccadilly Station

STATION PHASING - PHASE 1

4.3.3 The undercroft

Manchester Piccadilly station has a generous undercroft level that is currently blocked off from public access and use from all sides of the station footprint. An initial estimate suggests that there is potential for approximately 20.000sqm of gross area that sits under the station footprint. Half of which can be dedicated to retail and circulation and the other half can accommodate back of house and storage facilities as required. It is composed of a combination of undercroft systems that were put in place during different times as and when expansion to the station was required. [Image 16]

The station concept proposes to open the undercroft to retail and circulation use as well as the ongoing needs of the transport systems that are distributed around it such as back of house and storage and plant facilities.

The undercroft car parking is proposed to be relocated outside of the station. Car parking would ideally be organised to fit around the station in the surrounding development sites and buildings within easy walking distance to the future configuration of this transport hub.

4.3.4 Metrolink

The current Metrolink route and platforms within the undercroft of the Manchester Station presents a barrier that hinders any cross movements. The capacity of the current two platform arrangement will be exceeded with the introduction of HS2 and will require expansion to four platforms. Any future addition of passengers associated with NPR and future growth should also be considered.

TfGM have reviewed potential options for the relocation of the Metrolink. The common objective for the future alignment for the tram route around the station is to avoid severance and create opportunities for the use of the station undercroft area. Currently the plans are evolving around the concept of moving the tram line below of the station footprint and move the tram stop within easy reach of the station while improving connectivity and public amenity at the north side of the station. The tram line can stay below ground level in a shallow structure and can be located under the proposed Grand Arcade with easy interchanges with existing and future services.

The proposed Grand Arcade and tram stop are located in between the existing station and the HS2 station footprint, (with the HS2 station location adjusted to the north). The tram station and HS2 may overlap to optimise the width of the Grand Arcade; potentially two platforms could be completed below the Grand Arcade followed by two more platforms below HS2. Subsequent construction implications of HS2 site will need to be mitigated with a plausible construction phasing strategy.

4.3.5 Fairfield Street closure

Fairfield Street currently creates a barrier for pedestrian access along the southern edge of the station restricting access to the Mayfield Site to the south and beyond.

The street is currently proposed to be closed for circa three years to facilitate the construction of platforms 15 and 16 at Piccadilly Station. We propose that it is permanently closed between London Road and Travis Street to remove this barrier and greatly increase the permeability into the station.

The closure of this road would need to be the subject of further study to understand the viability of this proposal.

4.3.6 Coach station

The proposed station concept illustrates the potential relocation of the existing 8 stand Chorlton Street Coach Station to the south side of Piccadilly Station in the area currently utilised for drop-off and taxis (their relocation is described below). Closure of Fairfield Street would provide greater space available for the coach station.

The positioning of the coach station directly adjacent to the rail station would enable sharing of facilities (e.g. waiting, retail/leisure, toilets, baggage) between the coach and rail passengers. Its presence at ground level would help to catalyse the early uptake of retail space in the undercroft.

In this location, coaches would have very good access to the Manchester inner ring road (Mancunian Way) being 250m along a main arterial route (as opposed to the current location which has constrained access). It would also be an ideal position to facilitate rail replacement bus services.

Relocation of the coach station would free up a prime development plot within the core of the City centre.

There are multiple southbound bus routes along London Road. The coach station area could provide some bus stops / stands adjacent to London Road.

4.3.7 Taxi and drop-off

If Fairfield Street can be closed there is likely to be sufficient space in this area adjacent to the proposed coach station to accommodate a repositioned taxi and drop-off area.

Alternatively, the taxi and/or drop-off area could be relocated to the north side of the station at one of the following locations:

- To Store Street with improved station access;
- To the car park immediately adjacent to the Piccadilly train shed;
- To Boad/Sheffield Street;
- Or to the multi-storey car park located between Boad Street and Sparkle Street (already connected via a link bridge to the station).

Each of these northern options would then subsequently need to be moved following construction of the HS2 station.

4.3.8 Southern Entrance

The schemes delivered to this southern side of the station would be culminated with a new southern station entrance and public realm area. **A new southern entrance would mark the station's newly delivered southern permeability and be the first step to reinvigorating the station, its passenger improvements and its regeneration potential.**

4.3. 9 Piccadilly Station re-signalling

It is understood that there is a proposal for the re-signalling of Piccadilly Station. This should be undertaken in conjunction with the works to add platforms 15 and 16 in order to minimise cost and disruption.

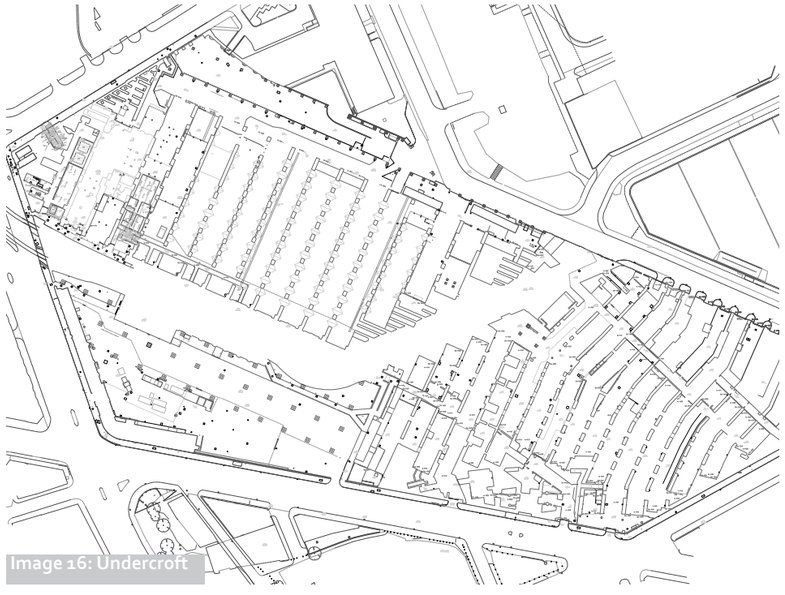


Image 16: Undercroft

Piccadilly Station

STATION PHASING - PHASE 2

4.4 Station Proposals – Phase 2

HS2 Phase 2 is programmed to commence full operation to Manchester Piccadilly in 2033. There is an aspiration that the HS2 station at Piccadilly is delivered by 2026 to provide the catalyst for regeneration alongside and for the potential population of the commercial opportunities within the station. There may also be an opportunity for it to be temporarily connected to the classic network in order to relieve capacity issues at the classic platforms of Piccadilly; however, this would require further study to assess the economic viability of this short-term measure.

Phase 2 consists of :

1. Arrival of the HS2 station with potential for early use by the classic lines
2. Creation of the "Grand Arcade" between the HS2 and the existing stations
3. Relocation of the taxi and drop off facilities north along HS2 station
4. Integration with retail and cross movements under HS2 station

4.4.1 HS2

HS2 station will form the last overground transport structure to be added to the Piccadilly station super hub.

HS2 will introduce a new synergy to the Piccadilly context with the need to connect local and regional and national services. Intermodal rail interchange will be as critical as the prominence of the HS2 station within the urban context of Piccadilly station in Manchester city centre. Highly efficient rail operations and servicing would be put in place to synchronise the networks with one and other.

The large ground floor space of the HS2 station would sit at the same level as the undercroft and the external ground levels to the east and south and add to the retail, passenger processing and circulation facilities that are taking place under the existing station footprint.

If it is found that the optimum location for the NPR platforms is below the HS2 station then the NPR station box should be constructed at the same time to reduce overall construction cost and disruption.

4.4.2 Grand Arcade

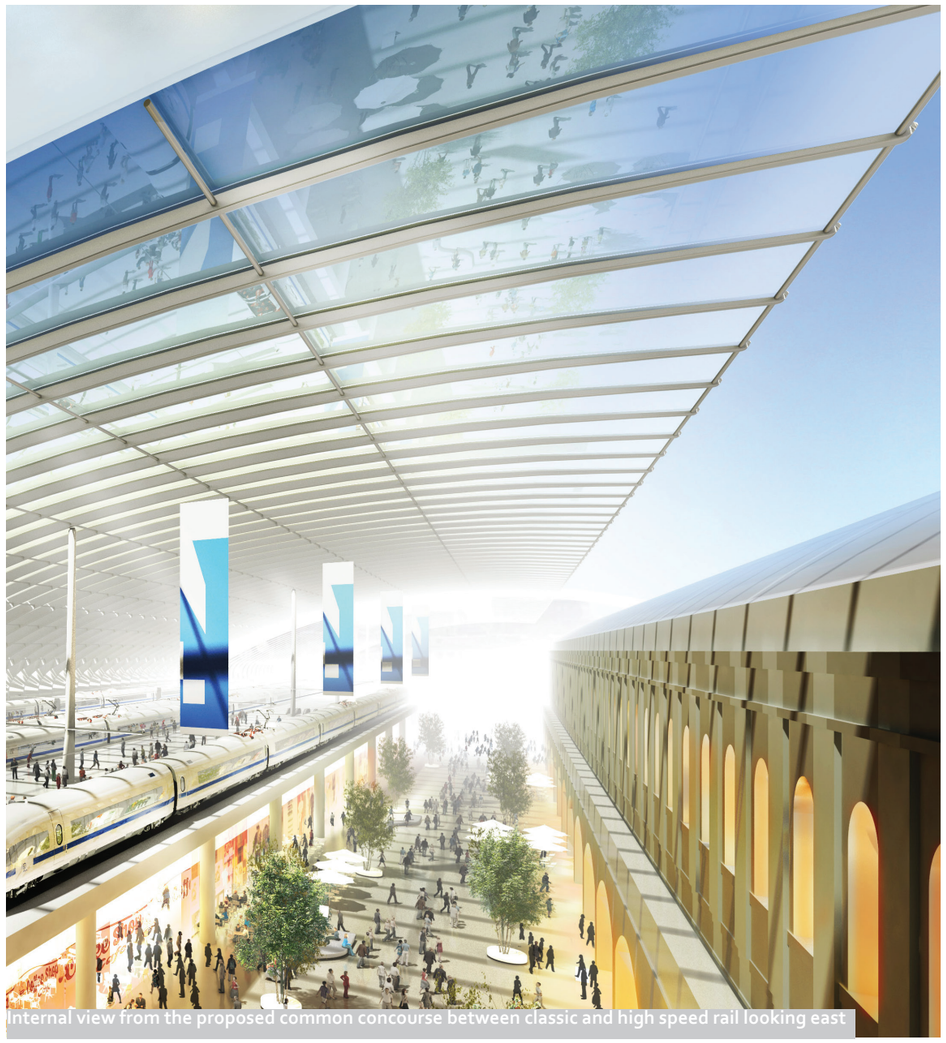
A "Grand Arcade" will now be formed in between the two grand structures of the HS2 viaduct and classic rail viaduct and train sheds. The pedestrian flows move comfortably in all directions and the east west connectivity link is enhanced with the introduction of the Grand Arcade.

The Grand Arcade will also be the means to connect all rail modes to each other with vertical circulation cores conceptually called "drums" would provide connection at all levels. The station vision foresees the connection of all rail modes vertically at designated vertical nodes. This will help strengthen visibility, legibility, connectivity and integration.

4.4.4 Taxi and drop-off

A taxi and drop-off area will be provided adjacent to HS2 on the north side. This may either be in addition to one provided with the coach station to the south or in replacement of one lost due to the construction of HS2.

These are important movements in and out of the station and during proposed phases of the station development should be planned to operate smoothly. Taxi and drop off areas are proposed to move to north of the HS2 station and benefit from its long northern edge for taxi ranking and queuing requirements.

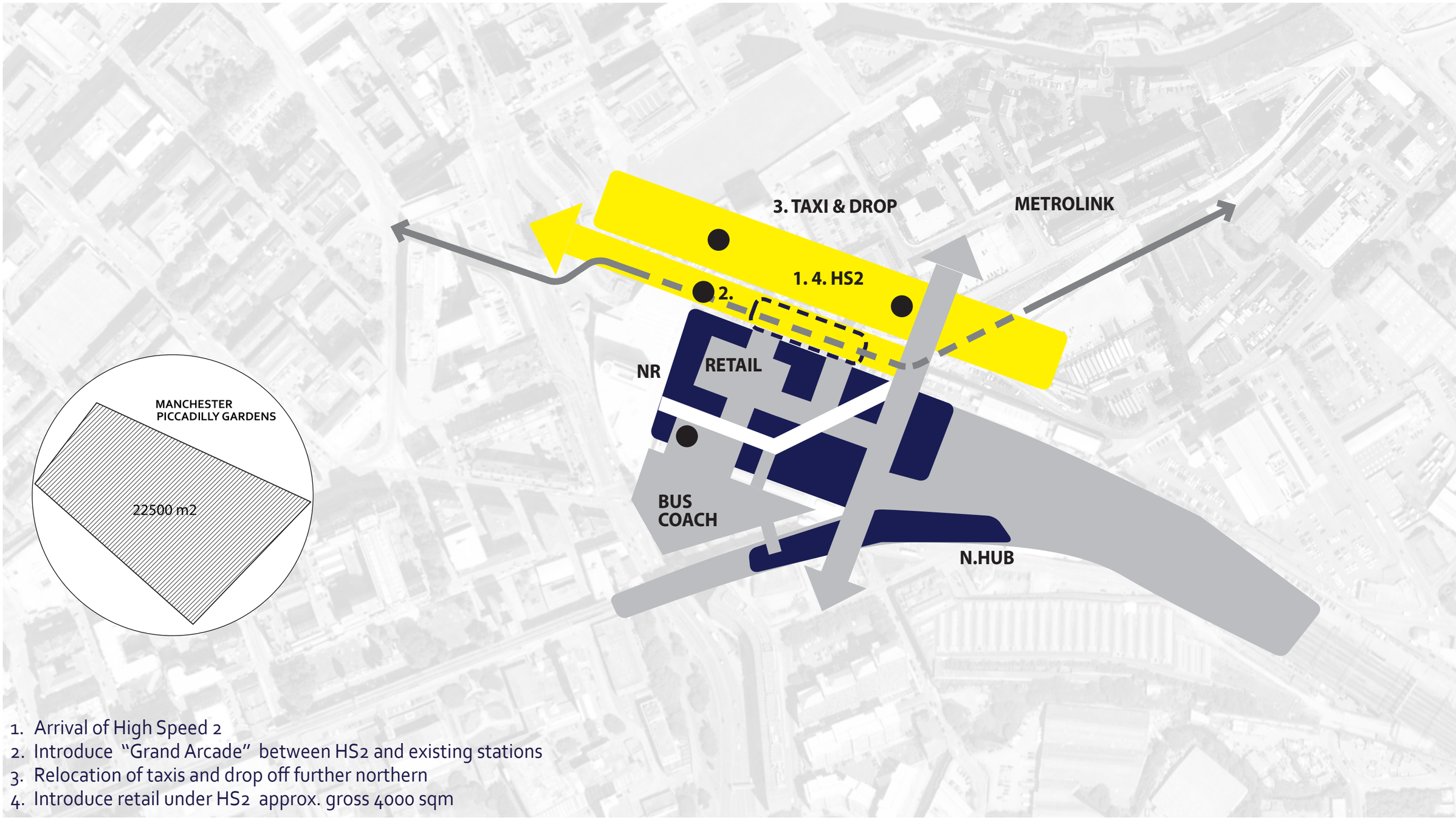


Internal view from the proposed common concourse between classic and high speed rail looking east

Piccadilly Station

STATION PHASING - PHASE 2:

Arrival of the HS2 station. Delivery of a single station roof concept to integrate high speed and classic rail and provision of the Grand Arcade and station approach piazza. Achievement of seamless integration between rail modes and maximisation of space, grandeur and passenger / pedestrian movement



1. Arrival of High Speed 2
2. Introduce "Grand Arcade" between HS2 and existing stations
3. Relocation of taxis and drop off further northern
4. Introduce retail under HS2 approx. gross 4000 sqm

Piccadilly Station

PHASE 3 - NORTHERN POWERHOUSE RAIL: Seamless integration of NPR below Piccadilly Station with effective passenger intergration

4.5 Station Proposals – Phase 3

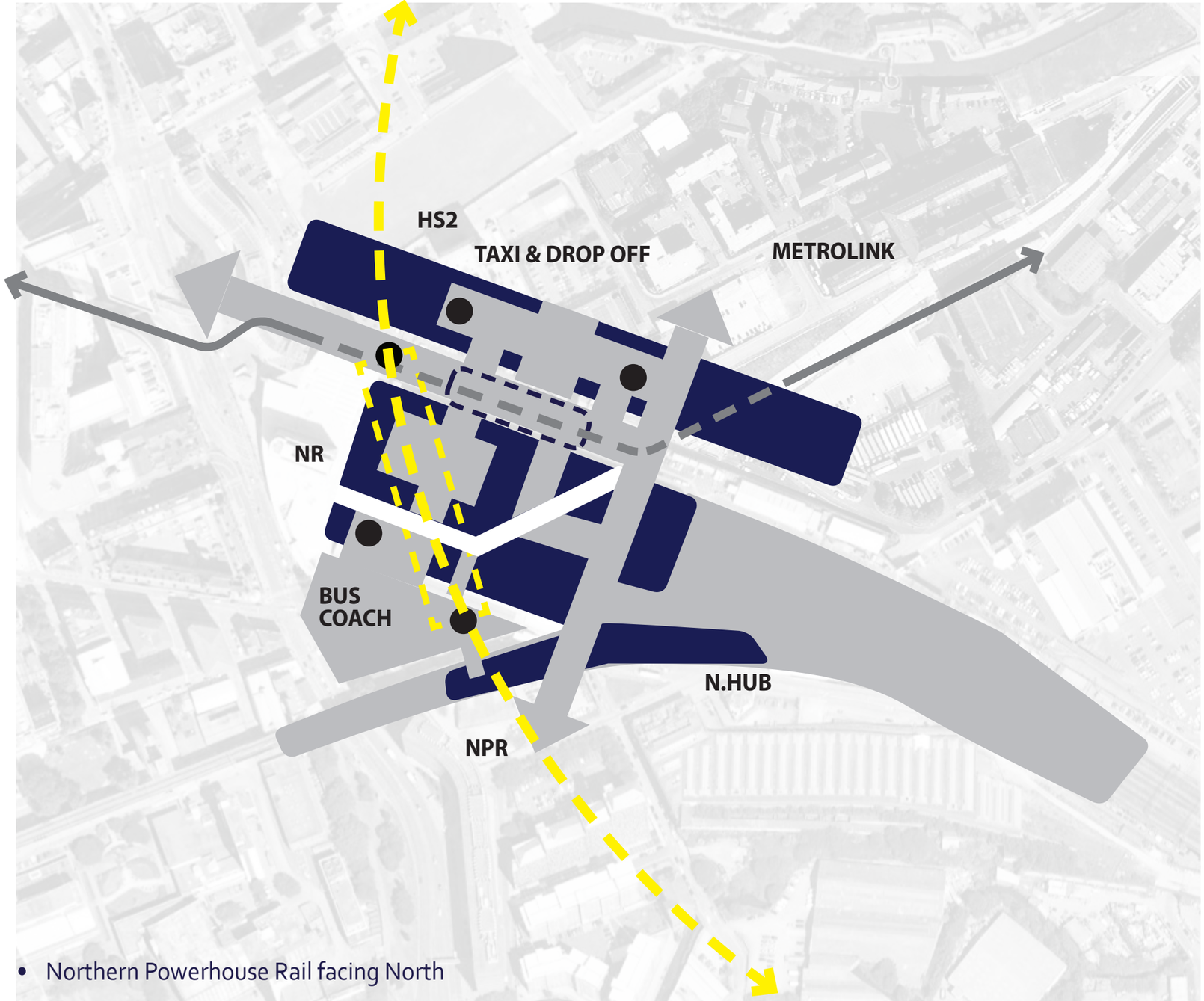
4.5.1 NPR station

Addition of Northern Powerhouse Rail and Station to the Manchester Piccadilly system will be the last step of the process of transforming the station in to a transport super hub.

The NPR station and its construction will need to be considered throughout the design and implementation of the other station improvements which form the station concept but which are delivered earlier.

The NPR station is proposed to stay underground on its way east as it passes through Manchester city. This provides opportunities and offers location and orientation alternatives. Staying under the existing Piccadilly station or positioning NPR under the HS2 station box will maximise interchange efficiencies and travel distances.

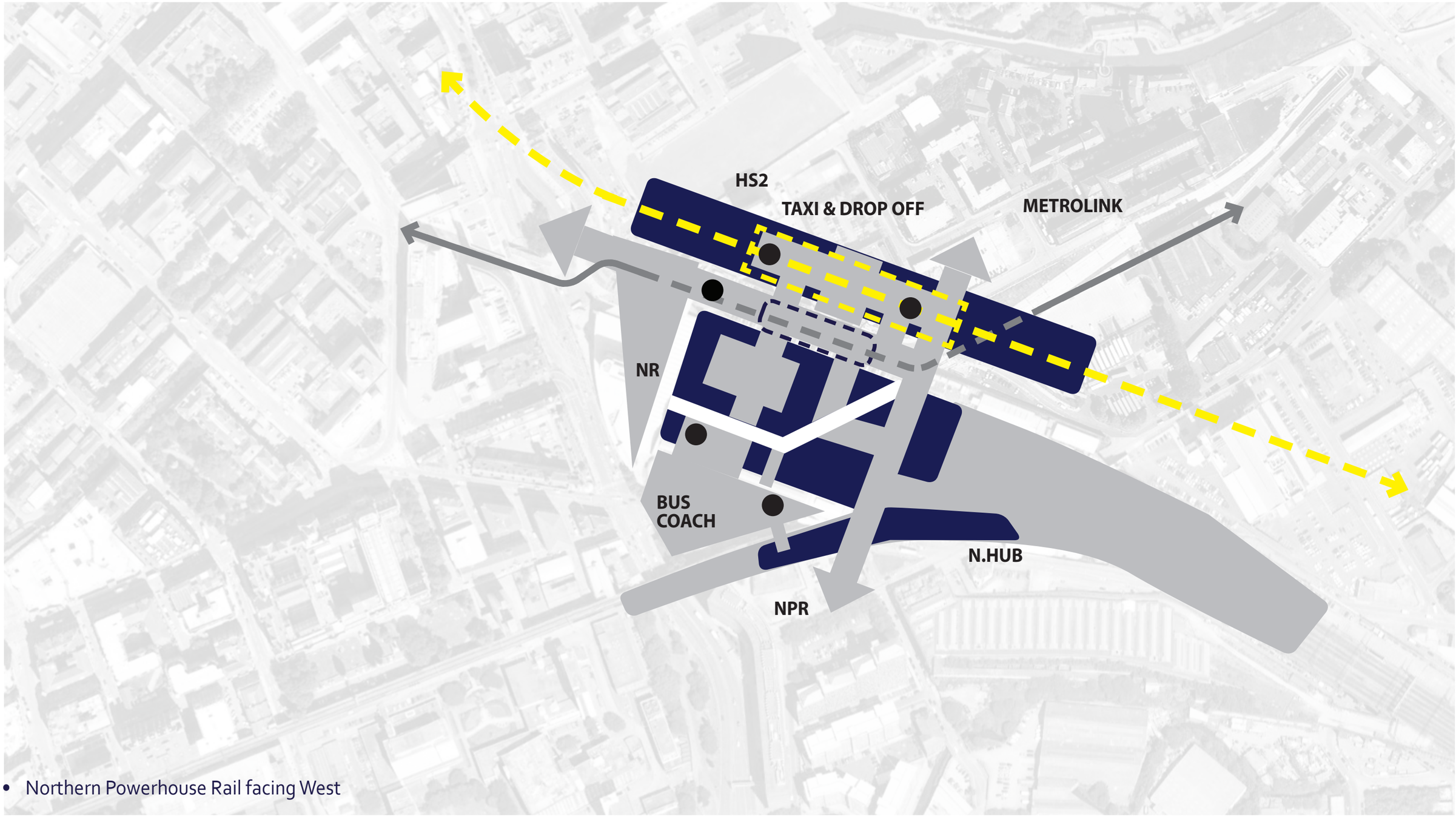
The orientation will also dictate the number of vertical connection cores also referred to as "drums" and their locations. The drums will have the function to connect all levels of transport to one and other at critical junction points.



- Northern Powerhouse Rail facing North

Piccadilly Station

PHASE 3 alternative - NORTHERN POWERHOUSE RAIL: Alternative alignment solution for NPR below Piccadilly Station

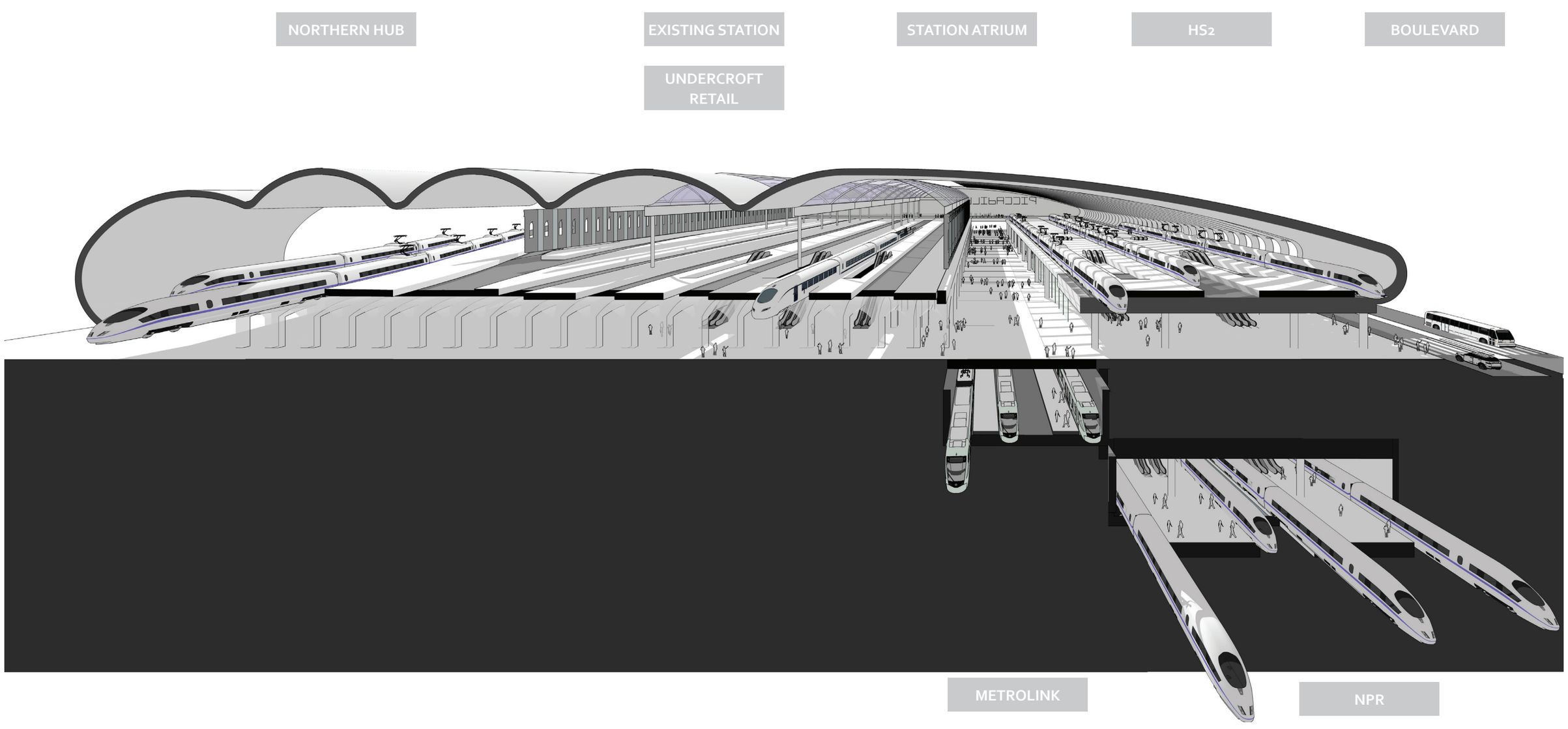


- Northern Powerhouse Rail facing West

Piccadilly Station

PHASE 3 - "Superhub":

A concept visualisation from the south eastern end illustrating the seamless passenger / pedestrian flow below the viaducts and the achievement of a single, integration transportation superhub



Piccadilly Station

FUTURE PROOFING, COMMERCIAL OPPORTUNITIES, ACCELERATION

4.6 Future Proofing Near-term Solutions

With major infrastructure additions to the Manchester Piccadilly Station and its context, it is essential to co-ordinate the timing of these large scale schemes and their construction stages. A major objective would be to avoid and mitigate any disruptions to the existing services and their operations. The passenger flows and revenue streams need to continue uninterrupted during the construction of the schemes in different or overlapped timeframes.

For an integrated final solution, the early schemes will need referencing and confirmation of the later schemes. The early schemes will also need to have sufficient flexibility built in to allow them to adapt to adjustment of future schemes.

An overarching construction programme could be identified at the start of the station works as a coordinated approach would avoid any duplication of building works which could cause ongoing disruption in the station environment. Any efficiencies in sharing of construction phases or works or spaceproofing for future schemes would be beneficial.

A long term Masterplan and Station Vision will need to be established and adhered to during the transformation of the station urban context. The vision would need to have set principles and objectives but also stay flexible and open to accommodation and integration of new adequately managed situation.

4.7 Maximisation of Commercial Opportunities

The station vision should be synchronised with the visions of the major stakeholders such as NR and HS2. The common denominator would be that all stations are safe and secure, offer sufficient capacity to service the increasing demand and offer an inviting environment where all people, regardless of their abilities, can easily transfer between different modes of transport as part of a seamless and satisfying overall journey experience.

The importance of good quality and safe interchanges to encourage public transport usage is well recognised by the station users. Passengers' experience of interchanging at stations is a vital aspect of their overall journey experience.

Creating this exemplary destination environment for the passengers, public and station operators and their staff would turn the station in to an ideal urban space to come back to for travel, for retail or a destination for leisure as well as work.

Station vision will need to be created around offering:

- **Accessibility**
- **Making best use of commercial activities**
- **Rebuilding of stations whilst maintaining operations**
- **Benefits of standardisation of station equipment**
- **Synergy between station business and real estate business.**

4.7.1 Station Asset Value

As the station vision is put in place to satisfy the aspects of seamless journeys and interchanges, place making and urban connectivity and integration, stations asset value will increase significantly.

In Piccadilly Station, the transformation of the station will bring together retail opportunities (shopping, food and beverage) that are spread across a floor plate of approximately 20.000sqm under Network Rail and High Speed 2 stations including circulation space. This is a substantial space comparable to the ground floor retail of St. Pancras.

As indicated in greater detail in section 2 of this report, the urban development and the transport hub as a catalyst and connector would provide the leverage for the station asset value.

The station premises would be able to offer a wide range of business opportunuites including retail, asset rental, storage, pop up shops and kiosks, social and cultural offerings.

Any over site development or station entrance orientated development would maximise the revenue potential for the station public and private stakeholders and landowners.

4.7.2 Impact to Regeneration

As indicated in our station vision and regeneration context proposals, developments at and around the site would enhance and benefit from the station as an attractor which would have a direct positive impact on the regeneration of the immediate and the wider station area.

The timing of the transport and regeneration schemes will be of high importance so that the investment can go ahead with the knowledge of and with reference to their adjoining and contemporary developments. The movements in and out of the station will enhance urban links and developments around the station will need to address to the place making qualities and physical and spatial response to the user activites.

Transport infrastructure has always leveraged urban development and transformation of urban spaces. In the case of Manchester Piccadilly station, the introduction of the multiple transport services to this transport node would also remove barriers and link the city centre with the city context around and beyond the station boundaries.

The delivery of Platforms 15 and 16 earlier than currently proposed will increase the initial regeneration values within the Mayfield site by increased station access from the site and reduction of subsequent disruption affecting access and perception of the area.

4.8 Opportunities for Accelerated Delivery

Acceleration of individual elements of the station concept will enable the early realisation of the benefits which they bring – whether direct passenger benefits or revenue streams from retail for example. The early provision of the coach station at the station would free up a valuable development within the city centre and release those funds sooner (which may be able to contribute to the funding of the station delivery). There would also be merit achieving consolidation of the individual changes in order to reduce the duration of disruption. Hence, the proposed delivery and consolidation of multiple schemes within Phase 1.

It is clearly preferable that early schemes are delivered with full consideration of later schemes to allow them to work as seamless elements once all are constructed. In order to achieve that there needs to be a degree of fixity and

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surety to those later schemes: i.e. HS2 and NPR.
Phase 1 would be likely to progress considerably earlier than the completion of detailed design of HS2 and NPR. Therefore, it is most dependent on early fixity of particular elements of these later schemes. There is also considerable dependency between the elements within the phase. The diagram below illustrates some of these key interdependencies for this phase. This is indicative based on consideration of the interdependencies rather than as a result of phasing/programming.

The positioning of the coach station described within the proposed station concept has been carefully positioned to not only provide the catalyst for the undercroft retail but also to enable the early vacation of its current location in the city centre.

The key element underpinning the delivery of the individual elements is an overarching station masterplan to allow the individual schemes to each be tailored towards that eventual form. The early production of this station masterplan would enable the early progression of some of the individual elements.

4.8.1 Platforms 15 and 16

The addition of platforms 15 and 16 is less dependent on the wider station masterplan and could be progressed at the earliest opportunity. However, it should be done so with due cognisance of the potential overall station masterplan.

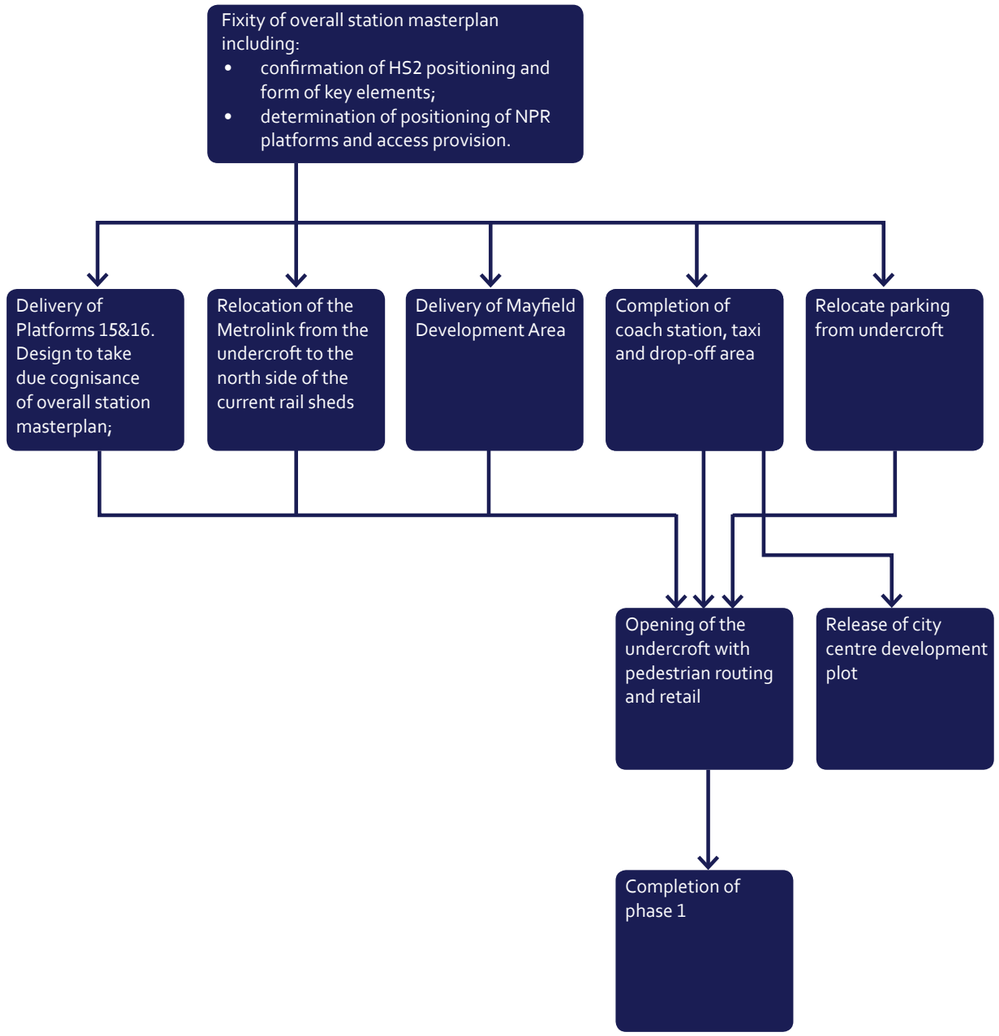
The Mayfield Development is critical interface for these works and their timing. The first buildings of Mayfield are targeted for occupation in 2020. The completion of platforms 15 and 16 and, particularly, the southern station entrance associated with them would aid the area's connection to Piccadilly and further catalyse the Mayfield areas regeneration. Therefore, the early delivery of the platform extension, prior to 2020, would be beneficial via improving accessibility and also by avoidance of disruption to occupants of Mayfield if the platform works were completed at a later date. It would also deliver improved train service access to this development area.

4.8.2 HS2

The arrival of HS2 is the milestone and catalyst in the regeneration of the Piccadilly Regneration Framework Area. Therefore, its early delivery would allow those regeneration benefits to be seen early.

4.8.3 NPR

The optimal positioning of the NPR platforms requires further study to determine. If it is found that the optimum location for the NPR platforms is below the HS2 station (as illustrated in one of the options illustrated in Phase 3 within this report) then the NPR station box should be constructed at the same time to reduce overall construction cost and disruption. It is essential that an early decision regarding the position of the NPR platforms is made to enable this.



Conclusion and Recommendations 5

Conclusion and Recommendations

Conclusion and Recommendations

5.1 Conclusion

Manchester's current station system, Northern Hub, HS2 and NPR can be reconciled to deliver the transformation necessary at Manchester Piccadilly to realise the significant opportunity that is available to Manchester and beyond.

In considering the location of the HS2 and NPR stations we have concluded that the HS2 station should remain on a new viaduct at the existing classic rail level and NPR station should be underground. The options indicated represent concepts for the NPR station location and further work is required to confirm the final location and orientation.

Our proposals conclude that all current and future rail modes are integrated together within the single coherent station building.

Relocation of the Metrolink below ground, in line with TFGM's preferred solution, will enable the increase in permeability while also placing it closer to HS2 and NPR services.

A key benefit of the Metrolink relocation is that it opens up the undercroft and provides opportunity for retail early in the development phase. It also gives improved access to both the Piccadilly and Mayfield regeneration areas and should leverage commercial development.

The construction of the Northern Hub platforms 15 and 16 have a significant impact to the early delivery of the Mayfield regeneration. Platforms 15 and 16 construction have now gone back to CP6 (2019 – 2024) whereas Mayfield is planned to deliver first developments by 2020, this could delay the full delivery of the planned regeneration.

Should the final NPR station location be under the HS2 station to complete the overall vision for the station the NPR station box will need to be built before or with the HS2 station viaduct.

It is also important to recognise that early construction of the HS2 station in 2026 is an aspiration to provide the catalyst for early growth and may potentially be used temporarily to create capacity for the classic rail services.

The permeability at ground level extends beyond the confines of the station to connect directly to the areas to the north, south and east of the station. Timing and early mobilisation is critical.

The phased delivery approach defined by Arup allows the earlier phases to be delivered with maximised benefits whilst supporting the ultimate station masterplan and delivery of a single seamless station.

As demonstrated within this report platforms 15 and 16, HS2 and NPR at Piccadilly Station can be reconciled into a single coherent station. Commercial opportunities can be maximised through expansion of station retail and greatly improved station permeability to the surrounding regeneration areas. This can provide a superhub for pedestrian and transportation interconnection fit for future growth aspirations of Manchester and the north. It can be delivered in a phased approach that realises station asset value improvements and regeneration benefits earlier.

Development of a clear long-term masterplan for the station and future elements will enable schemes that are delivered early in the process to be developed with full consideration of the eventual vision and form of the station.

There is a huge opportunity in realising the commercial and passenger potential of Piccadilly Station.

5.2 Recommendations

The following recommendations have emerged from this study:

- Develop and agree a masterplan to identify the final delivery of all the stakeholders' requirements for the station and surrounding elements;
- Establish a co-ordinated timeframe for the delivery of all the station elements;
- Further develop the fixity of the HS2 and NPR stations;
- Further develop the early opportunities to open up the undercroft to improve permeability and deliver commercial opportunities. This would require early relocation of the Metrolink station;
- Look to improve the alignment of timescales for the completion of the Northern Hub platforms 15 & 16 works with the regeneration works on the Mayfield site.

Assessment of Opportunities for Upgrade of the Manchester to Leeds Railway (via) Huddersfield

6

Assessment of Opportunities for Upgrade of the Manchester to Leeds Railway (via) Huddersfield

6. 1 Introduction

Arup have been appointed to investigate the potential upgrade options for the Manchester to Leeds railway (via the Huddersfield route). The upgrades are to focus on reducing journey times, gaining capacity and improving reliability. It has been undertaken within February 2016.

This work is undertaken in the context of the following two proposed rail development projects affecting this corridor, as follows:

6. 1.1 TransPennine Route Upgrade

The "TransPennine Route Upgrade" is as recorded in the Enhancements Delivery Plan Update (Network Rail, January 2016). This upgrade package is to be delivered by Network Rail by 2022, with a target journey time between Manchester to Leeds of 40 minutes. The contents of this package is currently being developed by Network Rail and is to be determined by the end of 2017. Due to the delivery timescales there will be insufficient time for land acquisition and therefore, we understand from Network Rail that all interventions within this package will need to be delivered within the existing Network Rail land ownership. Since the interventions will be within the existing rail corridor there may be extensive disruption during their completion.

6. 1.2 Northern Powerhouse Rail (NPR)

The NPR concept is being developed by TfN. At present there are no firm proposals; a business case is being developed by TfN along with routing options. TfN and Network Rail are presently undertaking studies to evaluate route solutions between Manchester and Leeds / Sheffield. The existing routes considered in these studies are the Calder Valley route, the Diggle route and the Hope Valley route. A number of potential new rail corridors are being considered.

6.1.3 Arup's Remit

Arup's remit is to identify the potential improvement options for the upgrade of the TransPennine route (via Huddersfield). These options shall aim towards both short and medium-term interventions aiming at maximising the capability of the existing line and identifying solutions for bringing benefits earlier if possible. The aspiration of the NIC is to explore options to go beyond the currently specified outputs defined in the Enhancements Delivery Plan Update. Short-term interventions are those that could potentially be added within the Network Rail package being delivered by 2022 – i.e. these may be able to be constructed within existing Network Rail land ownership, this is noted within the summary table in Section 3.3. It must be noted that due to the high level nature of this study, we have not be able to investigate the options to confirm whether these options would remain within the land ownership boundary. The medium-term interventions are those that may potentially bridge the gap between the 2022 package and the delivery of any future NPR scheme.

6.1.4 Methodology

There are four broad types of train which use the corridor:

- Fast services;
- Semi-fast services;
- Slow (all stopping) services;
- Freight services.

The layering of these differing service patterns causes a significant challenge in achieving fast journey times between the larger centres whilst also providing sufficient services at the intermediate stations. There are 14 intermediate stops between Manchester Victoria and Leeds; 18 between Manchester Piccadilly and Leeds.

Reduction in the frequency and pattern of stops at the smaller intermediate stations would enable additional fast and/or intermediate train paths to be added and provide improvement to headline journey time and fast train paths between the larger centres. However, this would have a negative effect on the rail service to these intermediate stops which form a vital connection for commuter and leisure traffic between these conurbations and contribute to the northern economy.

In order to improve overall journey time and service operation, there are two aspects that have been considered and which are addressed within this note:

- Operational (i.e. timetabling and rolling stock) improvements;
- Infrastructure improvements.

6.2 Operational Improvements

There are a number of operational improvements that could be made which would each produce an incremental benefit and contribute to journey time and capacity improvements. These could potentially be applied now, although they would need to be prioritised and implemented in a realistic combination.

Assessment of the impact of these is very complex as it requires the evaluation of the routing and interaction of all train service types and their stopping patterns / train paths along the proposed infrastructure of the route. As such, within the short timescale of this study, it is not possible to quantify the potential benefits of each of these. A qualitative description of the improvement each of these can offer is provided below.

We anticipate many of these improvement options will be considered by Network Rail in the development of their upgrade package for 2022. We have not had access to Network Rail's plans for this study.

6. 2.1 Rolling stock improvements

- Performance improvements – including faster acceleration, lighter and mechanical gearing designed for the topography. However, it should be noted that the Class 185 (used for the fast and intermediate services) is already well suited for this terrain and route.
- Rolling stock improvements for the slow services is vital. The present slow services have a top speed of 75mph and are rapidly caught by the fast services. Generally route capacity can be more effectively used when rolling stock on different services have relatively homogenous characteristics. If performance of the slow services was improved to a similar level to the fast and intermediate services, then a smaller gap would be required between fast and slow at the commencement of their journeys. This would allow potential additional train paths and improved service pattern spread.
- Lengthening of trains to provide additional individual train capacity. This could enable the reduction of train frequency whilst still achieving the same number of "seats per hour" along the route. However, the potential impact of the reduced service frequency on any generalised journey time and the benefits this drives in any associated business case should also be considered. The limitation posed by current platform lengths is discussed in Section 6.3.4.

6.2.2 Timetabling improvements

The existing TransPennine timetable has limited resilience to disruption (this can be evidenced from a number of performance measures including Public Performance Measures which has declined during the 12 months between Period 11 in 2014/15 and in 2015/2016. Expansion of the infrastructure capacity would play a significant part in addressing timetable resilience but a number of improvements could be made to help address that also:

- Many train paths travel a considerable distance to get to a specific time window slot in the timetable. The considerable distance travelled across a heavily congested network, raises a high risk of missing the timetabled slot. This then has a knock on effect to the wider service. Use of allowances in the timetable or possible splitting of certain trains services, could mitigate against this but with a potential disbenefit to users in terms of journey time and increased operating costs to the government.

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- Reduction of the number or type of train paths provided. Clearly it is not desirable to reduce the service, but a reduction in the frequency would aid the resilience of the network albeit with a potential impact on the local economy.
- Reduction in the frequency and pattern of stops at the smaller intermediate stations. This would enable additional fast and/or intermediate train paths to be added and provide improvement to headline journey time and fast train paths between the larger centres. However, this would have a negative effect on the rail service to these intermediate stops which form a vital connection for commuter and leisure traffic between these conurbations and contribute to the northern economy.
- Reduction of door opening times to reduce train dwell time. However this may not be possible at the busiest locations and will be dependent on a rolling stock design (particularly door location and width) and the interface with the platform.
- More effective management of station despatch and train loading. This will need adapting around particular station loadings that may delay departures.

6. 3 Potential Infrastructure Interventions

A high level review has been undertaken by Arup to identify potential infrastructure interventions to the existing route. This review has identified those short and medium-term interventions which are immediately apparent as providing particular journey time and/or capacity improvements to the route. A more detailed study (such as that being progressed by Network Rail in determining their 2022 package of works), could identify a much larger set of short-term interventions via the completion of a more detailed incremental step-through of the existing infrastructure constraints at a much finer level of detail (e.g. assessing potential improvements via individual junction improvements and/or alignment modifications). The timescale of this study mean that those very detailed considerations have not been evaluated.

The route infrastructure improvements identified by Arup have been based upon the following information:

- Network Rail electronic sectional appendix (accessed 5th February 2016);
- Railway Track Diagrams (number 2, Eastern, 2006; number 4, Midlands and Northwest 2013);
- Mapping and satellite imagery of the route;
- In-cab videos;
- Arup's prior knowledge of the route supplemented by input from Winder Philips Associates. The improvements identified have been targeted towards the following:
- Bypassing slow sections of the route and those with multiple intermediate stations;
- Increasing capacity through the provision of four-tracked sections. Provision of additional parallel tracks of sufficient length would provide a dynamic passing loop for fast trains to overtake slow services. The current route is predominantly two tracks (i.e. one track in each direction). Lengths of the route had previously carried four tracks but has now been reduced to two. It should be noted that following the reduction from four tracks to two tracks, the alignment has been optimised for speed (i.e. taking the straightest line around corners). Therefore, without additional land take, conversion back to four tracks may have an adverse effect on the line speed due to the tightening of radii to accommodate additional tracks around curves. It may be possible to three-track some sections with bi-directional running, however, this would introduce additional operational complexity;

- Addition of train turnbacks at intermediate stations. At present, slow services operate a shuttle service between Manchester and Huddersfield on the west and Huddersfield and Leeds on the east. Through the addition of turnbacks towards Manchester / Leeds at stations part way along both of those, it would be possible to shorten the travel length of a selection of the slow services and therefore, enable additional fast or intermediate services to run. Development of options would require a more detailed understanding of travel patterns to local stations on the route, particularly in the peak periods.

6. 3.1 Journey Time Savings Estimates

Estimating overall Manchester to Leeds journey time savings is complex. As described previously herein, journey times are dependent on both the infrastructure, rolling stock and timetabling. The infrastructure is a "fixed" aspect in the assessment, whereas the timetabling is the aspect which introduces the most complexity. Within the bounds of this study it is not possible to assess the timetabling aspect and how all of the services using the route would interact following the infrastructure interventions identified. Therefore, individual journey time saving estimates have been produced here for each specific infrastructure change (and their impact when compared to the present timetable). This at least enables some prioritisation of these interventions based on journey time savings achieved. However the time savings are not simply additive into a total time saving and detailed analysis and operational modelling would be needed to calculate these.

This assessment uses the current journey times on the existing network (based on current Working Timetables, Sectional Appendices) to produce a baseline and then using a series of assumptions, made an assessment of the journey time savings as a result of the alignment proposals.

6.3.2 Cost Estimates

A high level cost estimate has been produced for each of the route infrastructure interventions. No design has been undertaken for each intervention and therefore, the cost estimates have been produced upon their broad similarity with previous scheme cost plans. It may be considered as a GRIP 0 stage costing exercise and an optimism bias of 66% has been applied.

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6. 3.3 Summary of Route Infrastructure Interventions

To be read in conjunction with section 6.3.1 Journey Time Saving Estimates and the drawing in Appendix A for the location of these options.

No.	Title		Potential for inclusion by 2022?	Journey time saving (mins)	Total cost	"Cost per minute saved	Comments
	Location	Description					
1	M60 Crossing - Diggle Tunnel	Tunnel	N	6	£1,766m	£294m	Bypass four intermediate stations with a faster, more direct route.
2	Stalybridge Station Addition	New Platform	Y	-	£35m	-	An additional east bound platform would enable fast services from Manchester to pass slower services at this point, to aid the timetabling of fast and slow trains together.
3	Stalybridge - Diggle Tunnel	Tunnel & Disused	N	3.5	£1,355m	£387m	Bypass two intermediate stations with a faster, more direct route.
4	Uppermill	Turnback to Manchester	N	-	£10m	-	A turnback here to allow slow services from Manchester to return to Manchester at this point rather than continuing to Huddersfield. This would aid the pathing of fast and intermediate trains by removing some slow services between Greenfield and Huddersfield.
5	Greenfield - Diggle Tunnel	4 Track upgrades	Y	-	£62m	-	Provision of additional capacity on approach to Diggle Tunnel.
6	Diggle Tunnel	Re-opening of disused tunnel bore	Y	-	£160m	-	Additional capacity through the tunnel
7	Diggle Tunnel - Slaithwaite	4 Track upgrades	Y	-	£140m	-	Provision of additional capacity
8	Diggle Tunnel - Booth Bank	Tunnel	N	1.5	£468m	£312m	Bypass to avoid alignment constraint at Marsden.
9	Slaithwaite - Huddersfield	4 Track upgrades	Y	-	£114m	-	Provision of additional capacity
10	Slaithwaite - Ravensthorpe	Tunnel	N	5	£2,410m	£482m	Bypass three intermediate stations with a faster, more direct route; avoids Mirfield Junction. Journey time ignores stop at potential new Huddersfield station.
11	Huddersfield - Ravensthorpe	4 Track upgrades	Y	-	£308m	-	Provision of additional capacity
12	Ravensthorpe Station	New Turnback to Leeds	N	-	£10m	-	A turnback here to allow slow services from Leeds to return to Leeds at this point rather than continuing to Huddersfield. This would aid the pathing of fast and intermediate trains by removing some slow services between Ravensthorpe and Huddersfield.
13	Huddersfield - Morley Tunnel	Tunnel	N	3	£1,907m	£636m	Bypass five intermediate stations with a faster, more direct route; avoids Mirfield Junction.
14	Morley Tunnel - A653 Crossing	Tunnel	N	2.5	£1,018m	£407m	Bypass constrained Morley Tunnel and two intermediate stations with a faster, more direct route.
15	Huddersfield - M62 Crossing - A653 Crossing	Tunnel & Disused Track	N	10	£2,034m	£203m	Bypass seven intermediate stations with a faster, more direct route. Utilisation of the removed track route between the M62 and A653. The viability of the reuse of this length has not been assessed.
16	Huddersfield - A653 Crossing	Tunnel	N	10	£2,781m	£278m	Bypass seven intermediate stations with a faster, more direct route.
17	Leeds Station Approach	Disused Viaduct	Y	-	£64m	-	Utilisation of the disused rail viaduct at the Leeds station approach. This would bypass a significant portion of the existing track junction interaction on the approach to Leeds.

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6. 3.4 Platform Limitations

In addition to interventions along the route, to gain improvements to journey times and potential addition of train service paths, additional capacity may be gained on the route through the provision of additional carriages on the existing services. There are studies underway at present to consider platform capacity improvement at Leeds and Huddersfield (as part of the Intermediate Interventions noted in the Enhancements Delivery Plan 2016) and also as part of the West Yorkshire Train Lengthening scheme.

An assessment of the limitation that each station and platform poses to train service length has been undertaken based only on the information within the Sectional Appendix and Track Diagrams. A summary table is included below.

The green indicates that the particular service can be accommodated in both directions at that station, while the red indicates that lengthening work would likely be required to accommodate those train lengths shown. No shading indicates no stop.

	Fast/Intermediate Manchester to Leeds			Slow Manchester to Huddersfield			Slow Huddersfield to Leeds		
	6 Cars	9 Cars	12 Cars	2 Cars	4 Cars	6 Cars	2 Cars	4 Cars	6 Cars
Manchester Victoria									
Ashton-Under-Lyne									
Stalybridge									
Mossley									
Greenfield									
Marsden									
Slaithwaite									
Huddersfield									
Deighton									
Mirfield									
Ravensthorpe									
Dewsbury									
Batley									
Morley									
Cottingley									
Leeds									

Currently the fast / intermediate trains are limited to a maximum length of 6 carriages. An extension to 9 carriages (assuming continuation with the Class 185 fleet) would necessitate platform lengthening work at both Huddersfield and Dewsbury if the services were to continue to stop there, or selective door opening was not appropriate. Platform lengthening at Huddersfield is being considered as part of the Intermediate Interventions (Enhancements Delivery Plan Update; January 2016).

The Manchester to Huddersfield stopping services are currently prevented from utilising four carriage trains by existing platform lengths at Marsden and Slaithwaite. Extension to six carriages is limited by platform lengths at Mossley, Greenfield, Marsden and Slaithwaite.

The Huddersfield to Leeds stopping services are currently prevented from utilising four carriage trains by existing platform lengths at Deighton, Mirfield and Cottingley. All stations bar Huddersfield, Dewsbury and Leeds prevent lengthening of these services to six carriages. The stations between Huddersfield and Leeds are being considered for lengthening as part of the West Yorkshire Train Lengthening scheme currently underway by others.

6. 4 Conclusion

The achievement of journey time and capacity improvements on the route is a complex problem. The existing route is challenging both in terms of the high number of intermediate stops and the topography. This study has identified a series of potential operational and infrastructure improvements for the route that merit further investigation.

The improvements identified as potential short-term solutions should be considered by Network Rail within their 2022 package. The schemes that eventually make up an overall package will be heavily dependent on each other and cannot be finalised until all options are progressed to a level of detail to enable the infrastructure and train service pattern to be considered holistically (alongside any business case). The short term options need to be evaluated together.

A series of potential medium-term interventions have been identified. An initial estimation of potential journey time savings has been undertaken for lengths of new line; this is based solely on the individual infrastructure interventions against existing timetabling and these cannot be aggregated together. Actual journey time savings are a consequence of holistic route timetabling and as such, those journey time savings based on infrastructure may not be realised in reality.

There is a series of smaller interventions, which will produce a lessened journey time saving with a reduced cost and options have been identified to aid in the improvement of capacity on the route. Overall, however, any option can only be fully assessed through the holistic consideration of infrastructure and timetabling requirements.

Additional train capacity may be gained through the use of longer trains. This study has identified the existing stations which constrain the maximum train lengths along the route.

It is no doubt vital to deliver improvements to the TransPennine route quickly and efficiently. However, in order to deliver a cost-effective short to medium-term solution for the route, it should be considered coherently and inclusively with longer term aspirations of NPR to ensure that cost and disruption is minimised. The nature of the works means planned renewals and enhancements to the potential parallel diversionary route via the Calder Valley, would need to be completed first.

Ideally having an overall clear masterplan for rail improvements on the TransPennine route would be helpful. This should start from the Conditional Outputs being developed for NPR and then develop intermediate Outputs for the medium and short-term. This would enable the development of an optimised series of interventions which address short term 'quick fixes', mid-term solutions which are more substantial, but which 'fill the time/capacity gap' and then the ultimate final solution (longer term). These should be co-ordinated in order to balance early gains with minimisation of the overall cost and disruption to passengers.

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APPENDIX A - DRAWING