York Northwest Masterplanning & Infrastructure Study

Document: Version: 1

City of York Council

June 2011

Halcrow

York Northwest Masterplanning & Infrastructure Study

City of York Council

June 2011

Halcrow Group Limited
Arndale House, Otley Road, Headingley, Leeds
LS6 2UL
tel 0113 220 8220 fax 0113 274 2924
halcrow.com

Halcrow

Document history

York Northwest Masterplanning & Infrastructure Study

City of York Council

This document has been issued and amended as follows:

Version	Date	Description	Created by	Verified by	Approved by
1	31/03/2011	Draft	Stewart Stamper / Lynden Cable / Helen Dagg		
1	20/04/2011	Draft Final	Stewart Stamper / Lynden Cable / Helen Dagg		
1	08/06/2011	Final	Stewart Stamper / Lynden Cable / Helen Dagg	Stewart Stamper	Stewart Stamper

Contents

1 Introduction

1.1 Background

The York Northwest development corridor which includes the York Central and the former British Sugar and Manor School sites is a central element in the delivery of York's long term housing and employment growth.

The anticipated scale of development, the limited available highway capacity and the presence of operational rail uses pose significant challenges to realise the development corridors potential. This is especially the case at York Central which is bounded by operational rail lines including the East Coast Main Line (ECML), the Harrogate Line, York Station and the Freight Avoiding Line (FAL). The York Central development area is shown in Figure 1.1.

The cost of the new infrastructure to access the York Central site is a substantial risk for any potential developer and further design development will provide a greater assurance on the commercial viability.

The access routes to be examined in this commission are consistent with the Area Action Plan (AAP) which provides the overarching policy framework for the development sites.

The corridors are shown in Figure 1.1 and include:

- Access corridor A – via Chancery Rise;
- Access corridor B – via Holgate Park Drive;
- Access corridor C – via Water End; and
- Access corridors D, E & F – via Leeman Road.

This study also examines the feasibility of removing the existing Queen Street bridge and associated infrastructure to the south east of York Rail Station. The removal of the redundant bridge at this location will act as a catalyst for the redevelopment of this area of the city.

1.2 Purpose of this Report

The City of York Council (CYC) has commissioned Halcrow to examine the engineering feasibility, land take implications and cost of these new accesses into the York Central site. In doing so the commission needs to build upon the wealth of existing information available especially in relation to the York Central site. Conversely, whilst it is important to draw upon the existing evidence base it is equally important that the study has a clear engineering feasibility focus and examine the practicality of providing these major new junctions, highways and bridge infrastructure. The outputs of this study can then be reviewed by CYC officers and the York Central stakeholders alongside previous planning, traffic and environmental studies to draw firm conclusions on the most appropriate access points and the phasing of the infrastructure.

1.3 Land Availability

The majority of the York Central site is currently rail sidings with supporting rail infrastructure. Network Rail has been pursuing the rationalisation of this infrastructure through the Guide to Railway Investment Process (GRIP). The GRIP process is the regulatory framework which controls their relationship with the Train Operating Companies (TOC), Freight Operating Companies (FOC) and the Office of Rail Regulation (ORR). The GRIP process has eight stages in total and Network Rail has completed stages 1 to 3 for York Central. At the end of Stage 3 a single option was preferred which has received endorsement from industry stakeholders. The red line boundary, which is the main output from stages 1 to 3, defines the area of land available for development. This red line boundary examines the existing and future requirements for the rail infrastructure. The future requirements are a key consideration at York Central with the Leeds City Region pursuing the development of a Tram / Train improvements on the Harrogate Line alongside national infrastructure aspirations including the potential for High Speed Rail operations via York Station. Existing and future freight operations have also been considered alongside the requirements of rail engineering works, most notably the Thrall site which is situated to the south of the FAL. Whilst there will inevitably be continued dialogue and developments at a local, regional and national level, the endorsement of the red line boundary provides much needed assurance in relation to the bridge spans and highway alignments for each of the access corridors.

In addition to the GRIP red line boundary, CYC's Planners have identified six land areas which make discrete parcels of land available for infrastructure within York Central. Specifically discrete areas of land were identified at the northern end of the York Central site, each serving an individual purpose related to operational rail use. The areas of land are shown in Table 1.1.

Table 1.1 York Central Rail Uses

Area	Name	Purpose
1	York South Sidings	Stabling
2	Freight Loops	Hold freight trains up to 775m
3	NRM Running lines	Rail access to NRM Station Hall
4	Rail/ employment land*	Stabling and maintenance
5	Maintenance Delivery Unit*	Track/ rolling stock maintenance
6	Potential training centre site*	Potential Network Rail training centre

* Leeman Road Yard

Cumulatively, retention of all of these land areas for rail purposes was felt likely to prejudice the provision of a vehicular access to the site from Water End and Holgate Park Drive. In order to explore the comparative benefits of retaining or releasing these discrete areas of land, different combinations of land were compiled into a series of Rail Land Options as shown in Table 1.2.

Table 1.2 York Central Land Uses (Retail Scenario)

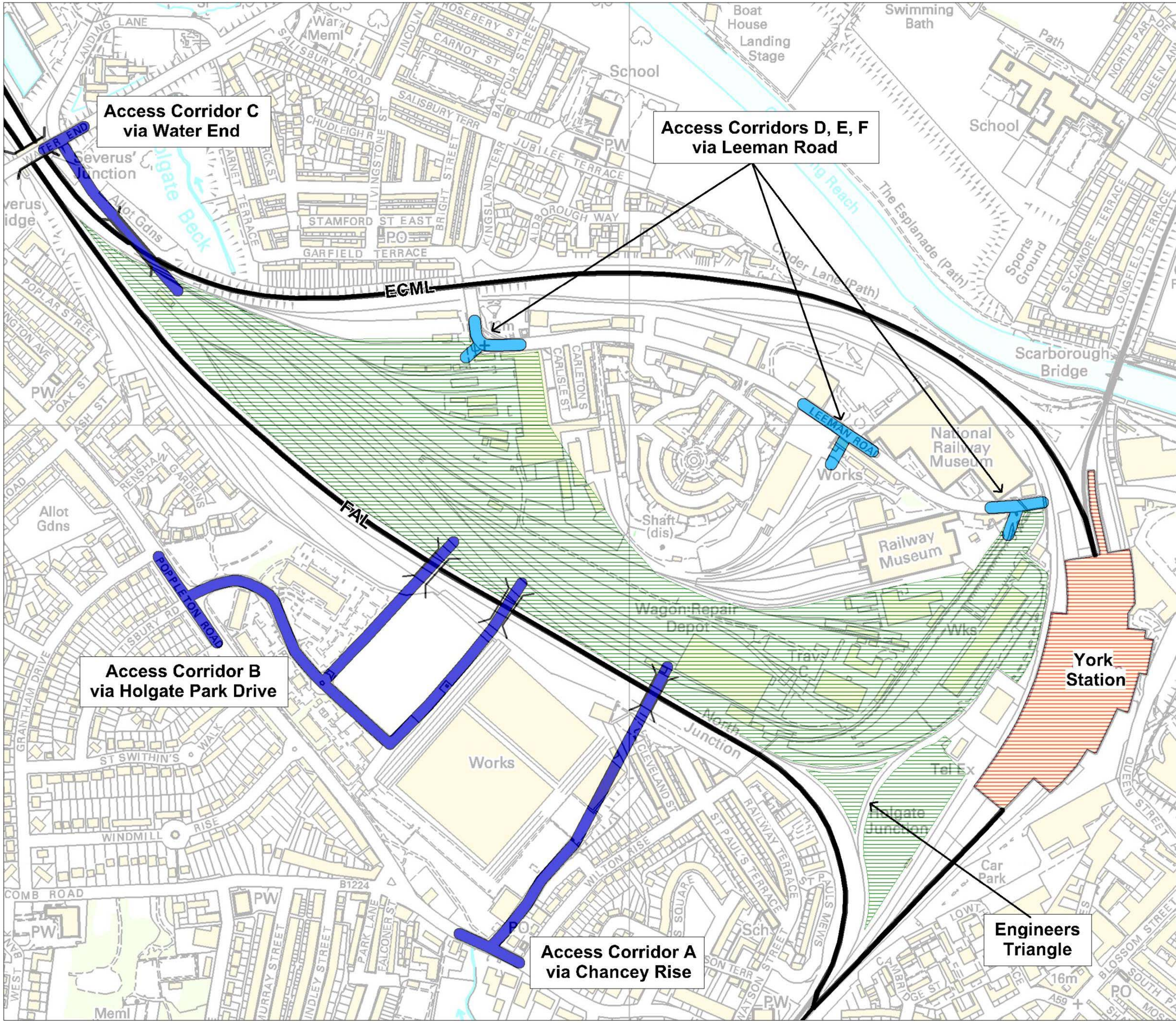
	Land retained for rail operational purposes?					
Scenario	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6
1	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	Y	Y	N
3	Y	Y	Y	Y	N	N
4	Y	Y	N	N	Y	Y
5	Y	N	N	Y	Y	Y
6	N	N	Y	Y	Y	Y

For each of these rail land options developed by CYC there is consistency with the red line developed as part of the GRIP process with a 4.5 metre offset from existing and future operational rail lines. The six rail land options are shown schematically in Figure 1.2 with accompanying detailed versions in Appendix A of this report.

1.4 Report Structure

The remainder of this report is structured as follows:

- Chapter 2: discusses the development proposals for the York Central site and the implications this has for the design of the access junctions and corridors
- Chapter 3: discusses the junction, highway and bridge design standards to be adopted within the Access corridors
- Chapter 4: outlines the proposals for the Chancery Rise Access
- Chapter 5: outlines the proposals for the Holgate Park Drive access
- Chapter 6: outlines the access proposals for Water End
- Chapter 7: outlines the access proposals for Leeman Road
- Chapter 7: presents the investigations into the demolition of the Queen Street bridge
- Chapter 8: provides an overall summary of the investigations undertaken as part of this study



Key
- Primary access corridor under consideration
- Secondary access corridor under consideration
- York Central approximate development area

CITY OF YORK COUNCIL

Halcrow Group Ltd
Arndale House
Otley Road
Headingley
Leeds
LS6 2UL

Halcrow

Project:
York Central Bridge Engineering Study

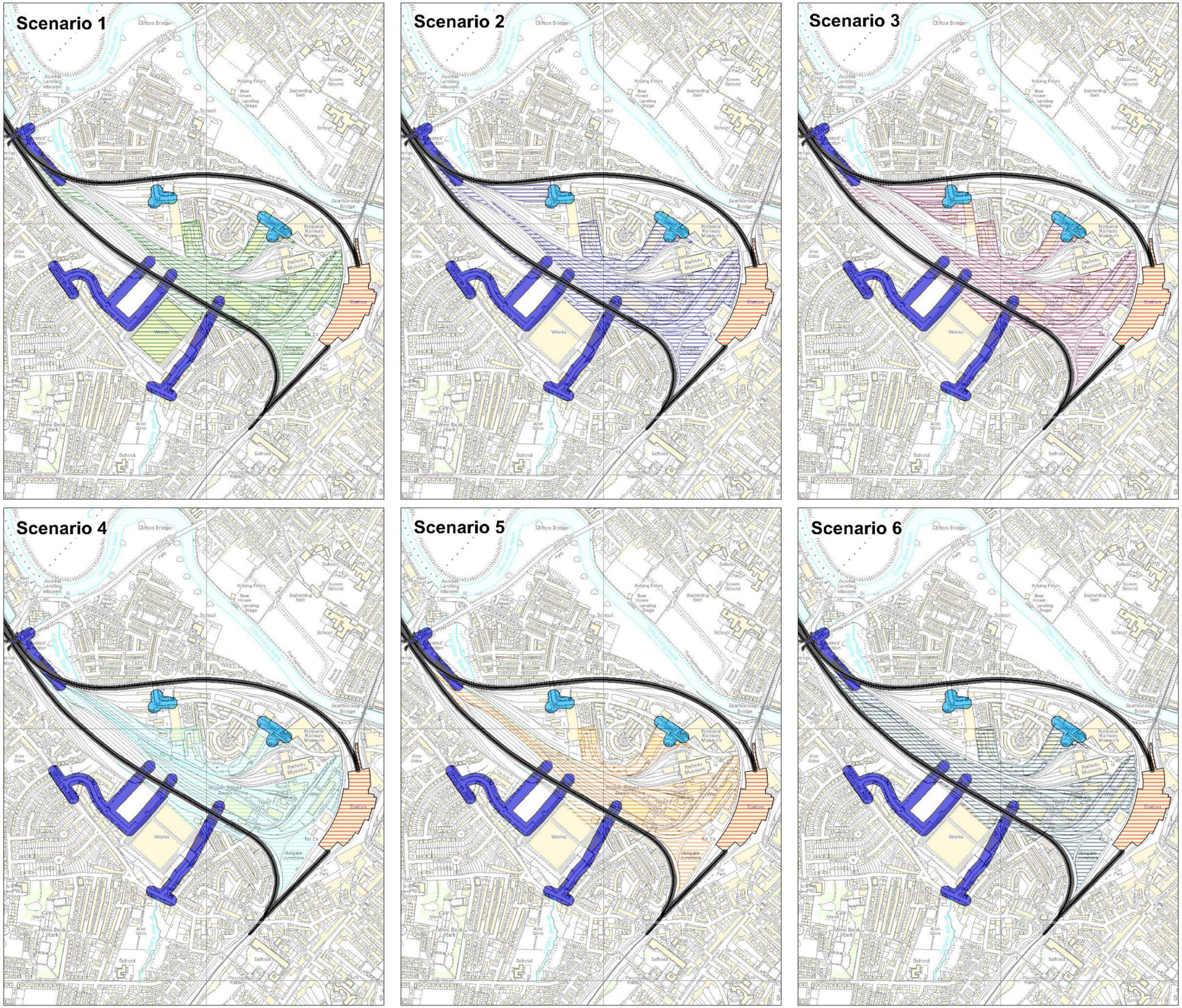
Drawing:
Development Site & Access Corridor

Drawn by:	Pamela Murray	Date 17/02/11
Checked by:	Stewart Stamper	Date 17/02/11
Authorised by:	Stewart Stamper	Date 17/02/11

Drawing No.: CTDAOB 001
Revision 1

Drawing Scale:

Drawing reference: Figure 1.1



Key

- Primary access corridor under consideration
- Secondary access corridor under consideration

Halcrow Group Ltd
Arndale House
Otley Road
Headingley
Leeds
LS6 2UL

Project:
York Central Bridge Engineering Study

Drawing:
Rail Land Option

Drawn by:	Pamela Murray	Date 17/02/11
Checked by:	Stewart Stamper	Date 17/02/11
Authorised by:	Stewart Stamper	Date 17/02/11

Drawing No.: CTDAOB 002

Revision: 1

Drawing Scale:

Drawing reference: Figure 1.2

2 Development Proposals

2.1 Introduction

York Central is a strategic project for the City and the Leeds City Region. The scale of York Central provides major opportunities for growth on an unprecedented scale with the developable area nearly three quarters the size of the existing walled city. The vision is to create a new district that complements and enhances the historic core and integrates into the surrounding built environments. Realising the development opportunity will have a significant impact on the City and Region's economy. The purpose of this chapter is to outline the development proposals and the resultant implications this has on the junction layouts and characteristics of the highway link design at Chancery Rise, Holgate Park Drive and Water End.

2.2 Development Quantum

The proposals for the site have been developed and informed by the Area Action Plan (AAP) process alongside parallel retail, residential and leisure studies. The aspiration is to create a new urban quarter around York railway station which will provide new office, leisure, retail and residential developments and facilitate the expansion of the National Railway Museum. Further west the development will be less intensive and be predominately residential with ancillary leisure uses and new educational establishments. The proposals for the site have been informed by work towards the development of a planning framework and transport masterplan for the York Northwest area, informed by key evidence base studies, including strategic transport modelling work. The most recent strategic transport modelling work has been used to inform the trip generation and modal share assumptions taken forward in this study.

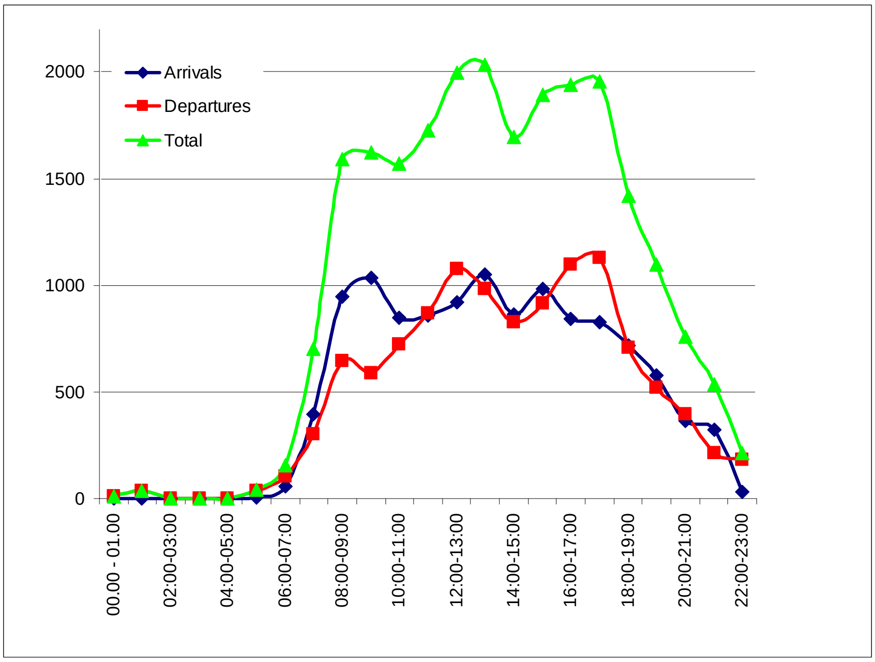
2.3 Trip Rates

Previous work has been undertaken by Halcrow on the proposed development quantum. This work established the baseline transport mode share for each of the proposed land uses and the predicted number of trips arriving and departing in the morning (8-9 am), interpeak (11-12 pm) and evening peak periods (5-6 pm). A summary table of movements is provided in Table 2.2. The outputs of this assessment provide an indication of the predicted movements by each transport mode. Further work was undertaken to give an indication of traffic movements throughout the day. The flow profile of trips is presented in Figure 2.1. The analysis shows the impact of the retail quantum on predicted movements with the inter peak periods nearly 30% higher than the morning peak period. The analysis also indicates that in the region of 2,000 car trips maybe accessing and egressing the site during the busiest periods.

Table 2.2 York Central People Trip Generation and Mode Share

Mode	Arrivals AM (PM)	Departures AM (PM)	Mode Share
Pedestrians	520 (390)	290 (590)	19%
Cyclists	250 (150)	155 (260)	9%
Public Transport (incl bus and rail)	590 (430)	224 (720)	21%
Motorcycle	20 (10)	19 (20)	<1%
Car Driver	950 (960)	646 (1250)	41%
Car Passenger	170 (290)	106 (330)	10%
Total	2500 (2230)	1450 (3160)	100%

Figure 2.1 York Central Car Trips Flow Profile



2.4 Strategic Transport Modelling

The outputs of the mode share and trip generation analysis were input into the York Transport model which covers the whole of the city. A number of underlying assumptions underpin this model including:

- the relocation of the existing rail station car park into the York Central site
- a point closure on Leeman Road in the vicinity of the National Railway Museum (NRM) to facilitate the creation of a new public square
- the implementation of Access York Phase 1
- construction of other known committed and planned development sites consistent with planning assumptions up to 2021 including the British Sugar site which also forms part of the York Northwest AAP

Those seeking a more comprehensive assessment of the modelling assumptions and strategic assessment should refer to Halcrow Technical Notes YC1 to YC8 which accompanied this earlier commission.

2.5 Predicted Junction Turning Movements

The strategic transport modelling work demonstrated the requirement for at least two multi-modal access points into York Central to support the anticipated transport demand outlined in Figure 2.1 in addition to supporting network capacity improvements, most notably on the A1237 York Outer Ring Road. The assessment considered Access Point B (Holgate Park Drive) and C (Water End) as the primary access corridors as Access Point A was not under consideration during the study period, though is very similar in nature to access corridor B.

The predicted traffic movements for these primary access points are displayed in Figure 2.2 and Table 2.3. The traffic flows are based upon the strategic model outputs and observed present day flows. The predicted traffic flows for Access Point A have been inferred from Access Point B given their proximity. The modelling assumed a three arm traffic signalled junction layout at Water End and the use of the existing junction arrangements, including modifications being pursued as part of the Access York Phase 1 proposals at the Holgate Park Drive junction.

Table 2.3 also displays the existing traffic flows which uses the Holgate Park Drive junction as this junction currently provides access to employment sites including the Thrall works.

Figure 2.2 Predicted traffic movements at Access corridors A, B & C (2021 Horizon Year)

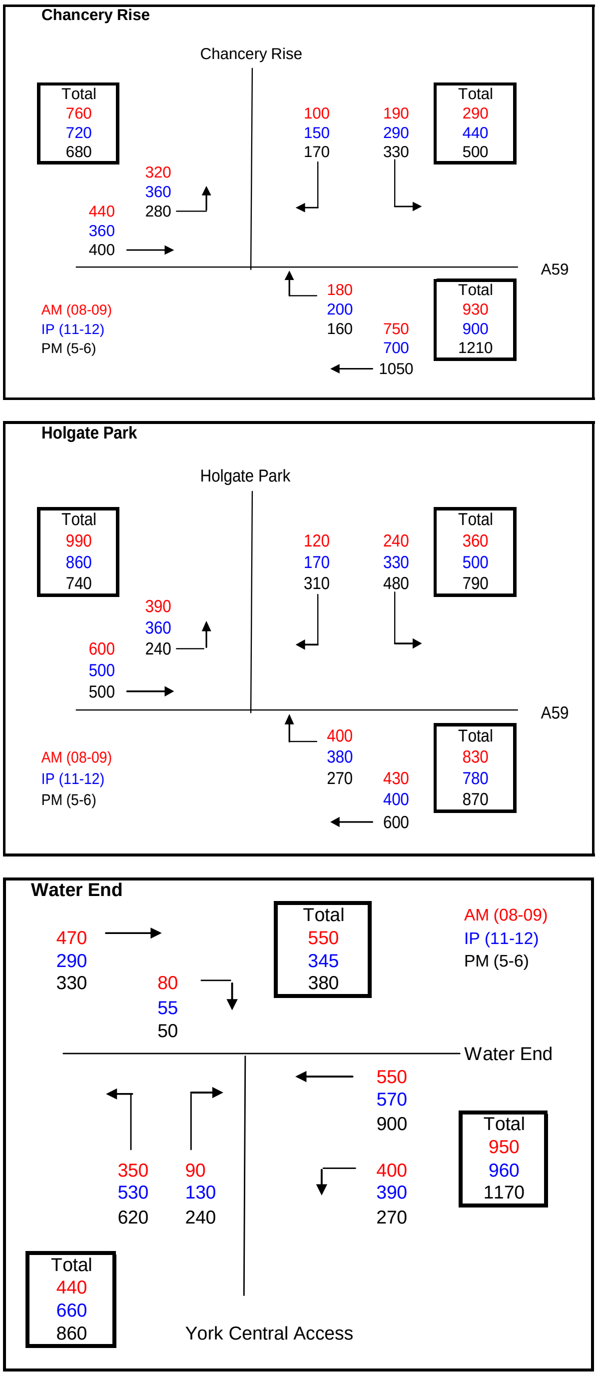


Table 2.3 Summary of traffic movements at Access corridors A, B & C in and out of the York Central site (2021 Horizon Year)

Access	AM		IP		PM	
	In	Out	In	Out	In	Out
A	500	290	560	440	440	500
B	790	360	740	500	510	790
B (existing)	340	40	50	40	25	270
C	480	440	445	660	320	860

Figure 2.2 and Table 2.3 indicates that 500 vehicles could be accessing York Central via Chancery Rise during the morning peak period. A similar number of vehicles are predicted at Water End with 480 inbound vehicles in the morning peak. A higher number of inbound vehicles are predicted at Holgate Park Drive access with 790 vehicles in the morning peak period. The higher inbound flow at Holgate Park Drive reflects the existing development site traffic flows. Less traffic is predicted to exit the York Central site during the morning peak period.

In the inter peak period slightly higher flow patterns are observed to be entering and leaving York Central. This corresponds with Figure 2.1 flow profile of trips throughout the day. During this time period the Holgate Park Drive access will experience a substantial increase in traffic levels compared to the existing situation.

The evening peak period is expected to experience the highest outbound traffic movements as visitors, shoppers and employees depart the site. The traffic modelling predicts a significant proportion of this traffic will choose to use the Water End access.

Analysis of traffic flows on the City's highway network indicate the predicted two way flows on each of these access corridors is comparable to current traffic volumes on Acomb Road.

2.6 Conclusions

The York Central development will provide a step change in the City's economic productivity. The scale of development even with progressive sustainable mode split targets could generate over 2,000 vehicular movements an hour during the busiest periods.

The peak traffic period for the preferred development quantum is the inter peak which reflects the significant volume of retail and leisure sites proposed within the current masterplan proposals.

Whilst the final development quantum, underlying assumptions and transport policies and strategies will undoubtedly change the strategic model has provided an anticipated snapshot of vehicular movements at each of the access corridors interface with the existing road network. This traffic flow information will be used to inform the junction and highway link designs for each of the access corridors.

3 Design Standards & Considerations

3.1 Introduction

The access corridors need to have a consistent design which meets the requirements set out in the York Highway Design Guide. In addition the infrastructure improvements should be in accordance with other relevant design guidance including Manual for Streets, the Design Manual for Roads and Bridges (DMRB) and relevant Local Transport Notes (LTN).

The purpose of this chapter is to outline the principal design standards which will be adopted within the access corridors. This section of the report also considers any overarching design considerations which affect the concept designs which are to be developed in subsequent chapters.

The access corridor comprise of three key components:

- junction improvement with the existing highway network
- provision of a new highway alignment
- new bridge structure to cross the rail infrastructure

This chapter and subsequent chapters thereafter which consider access corridors are framed by these three infrastructure components.

3.2 Junction Improvements

The junctions will act as the gateway for the multi-modal access corridors and it is important the improvements meet the requirements of all modes of transport. The interface of the primary access corridor with the local highway network is therefore of critical importance to the success of York Central

The provision of a safe junction arrangement is also important. The design will need to meet the anticipated travel demand, as a congested junction will not only affect the commercial viability of York Central but also be to the detriment to existing policies and proposed strategies being developed by the City Council. Notwithstanding this the junction performance, layout and design should be consistent with neighbouring junctions and the overall setting and location of the access corridor within the fabric of the city. The provision of a junction design which has significant inbuilt capacity or a layout which is inconsistent with the surrounding network may cost more to deliver and encourage vehicular trips to the York Central site. Furthermore, the ability to engineer vehicular capacity improvements in the vicinity of the access corridors is limited. Given these constraints any wider package of improvements delivered as part of York Central scheme on the radial corridors (aside from the A1237 capacity improvements) will be geared towards sustainable modes rather the provision of significant additional network capacity.

The improvements also need to be set in the context of the proposals contained within Access York Phase 1. These proposals include major infrastructure changes for the A59 corridor and include a series of junction improvements, bus and cycle lanes, capacity improvement at the A59/A1237 roundabout and the introduction of a new Park and Ride service. The measures are geared towards encouraging mode shift from car to park and ride (P&R) and the provision of the integrated package of measures for the A59 corridor enhances the level of mode shift achieved. Therefore the interface for the York Central access corridors needs to accommodate the programmed improvements and where feasible seek to enhance the P&R operations in addition to local bus services as this will form a key component of the sustainable transport strategy for York Central.

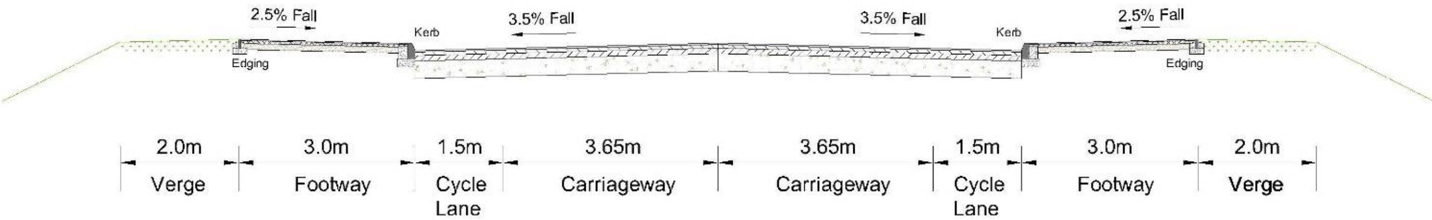
The access junctions and the wider network improvements also need to be consistent with the cycling design standards adopted by the City Council as part of the Cycling City initiative. These standards have set a new benchmark and are designed to cater for the differing levels of cycling ability. Recent improvements, for example, on the A19 Fulford Road have adopted these standards and have provided significant improvements for cyclists, contributing to increased cycling usage. Emulating these standards within the designs for York Central will encourage cycling use for the new development and the city as whole.

The provision of a phased programme of works for the junction improvement may also assist the commercial delivery of the York Central site. Building the ultimate junction footprint at the outset may not be necessary, especially given the indicative 10 to 15 year development time frame.

3.3 Access corridors

The multi-modal access corridors will be 16.3m wide. This comprises of two 3.65m traffic lanes, two 1.5m on highway cycle lanes and two 3.0m footways. This is based on the City of York Highway Design Guide for a Local Distributor Road and has been developed in consultation with their Network Management, Transport Planning and Engineering Consultancy teams. Figure 3.1 provides a cross section of the access corridor to be adopted within the designs.

Figure 3.1Proposed Footprint of the Access corridors



In addition to the 16.3m corridor footprint additional land will be required for landscaping on either side of the footway. A two to three metre landscaping buffer is detailed in the York Highway Design guide. However, this is an indicative figure primarily used to inform the setting out of new housing developments and does not reflect the individual circumstances for each of the access corridors under consideration in this study. For example, where an access corridor has a significant adverse impact on existing soft landscaping there will be a much greater need to acknowledge this loss within the proposed design solution.

There will also be a requirement for localised widening of the access corridors to accommodate side roads into existing and proposed developments. Further areas of land will also need to be reserved to provide flexibility for the access corridors. The areas of land reserved for highway operations could provide dedicated public transport priority or support additional capacity improvements at the junction improvements.

The geometric design standards for a Local Distributor Road are set out in Table 3.1. The 6% design gradient is a key consideration given the requirement to provide elevated structures above rail lines.

Table 3.1 Geometric Design Standards for a Local Distributor Road (Source: York Highway Design Guide)

Geometric Feature	Geometric Standard
Design Speed	30 mph (48kph)
Minimum Carriageway Width	6.5 metres minimum (7.3m may be required where traffic types dictate)
Footway width	2 no. at 2.0m minimum. Segregated from carriageway by verges
Verges width	Average 2 metres (variable width recommended for visual interest – 3 metres minimum where no footway provided)
Minimum centre line radius	60 metres
Maximum gradients	6%
Minimum gradients (all roads, footways, footpaths and cycleways	1%
Maximum vertical curvature	K=6.5 Minimum curve length = 30m
Minimum visibility over vertical crest curves	600m
Maximum gradient at junctions	5% for a distance of 10m minimum (Gradients of footways at junctions shall not exceed 10%)
Junction spacing	Same side: 60m Opposite sides: 35m
Minimum kerb radii at junctions	10m

3.4 Bridge Design

The design of the cross section of the bridge needs to be consistent with the cross section of the highway. The DMRB requires the width between the kerbs to be continued through the structure (TD27/05 clause 5.3.1). This will be adopted in all cases however depending on the form of the structure proposed, the footways may be slightly altered.

Network Rail standards have been considered. For a line with overhead line equipment which forms part of the Trans- European Network the headroom required is 5.8m (source: Track Design Handbook NR/L2/TRK/2049).

In addition, a 4.5m rail offset has been adopted to position abutments or piers. At this offset, the structure does not need to be designed for train derailment loads.

As an initial proposal and to generate the vertical highway alignment in all cases the road level is taken to be 7.8m above rail level. This comprises 5.8m required headroom clearance with an allowance of two metre for the depth of the deck construction including surfacing. The two metre construction depth is appropriate for single simply supported spans of up to 44m and traditional construction of a concrete bridge deck supported by either steel or concrete beams. Spans of over 44m may also be supported on bridge decks under 2m depth if alternative construction techniques are utilised although this may result in a less efficient bridge deck design. The road level of 7.8m has been used to generate the vertical alignment for the purposes of this high level feasibility study. For spans greater than or less than this the vertical alignment may need to be revised at the detailed design stage. This is reflected in the application of a 44% optimism bias to infrastructure costings at this initial design stage. On the bridge concepts provided, if the span requires an alternative construction type and this cannot be accommodated within the construction depth allowance, the actual headroom provided will be shown on the concept drawing. In some instances this will allow the vertical alignment to be lowered however in other instances the vertical alignment will need to be raised. This has consequential effects as it will increase the quantity of earthworks and given the topography of the site and the constraints at tie in to the existing alignments the highway gradients may exceed the design standard. These issues are flagged in the bridge design text where appropriate.

A topographical survey has previously been undertaken on the York Central site however this did not include levels on the FAL. For concepts where bridges cross the FAL an assumed rail level has been taken. This is the level of the adjacent track plus 200mm. Given the site is relatively level and that there is a common set of points with the adjacent sidings this is an appropriate assumption. Other sources of topographical survey information outside the York Central site have also been used to generate the vertical alignments and in the case of the Chancery Rise access a series of spot level measurements has been undertaken.

On roads with a speed limit of 50mph or less over railways which have overhead electrified line equipment there are specific requirements for parapets. The parapet specification is performance based, for the York Central site the requirement is for Very High Containment Level H4a. The height of the parapet must be a minimum of 1.5m although in areas of high vandalism this is required to be 1.8m.

The parapets need to be anti-climb therefore there can be no toeholds on the traffic face and access needs to be prevented to the non traffic face. This is achieved on metal vehicle parapets by additional solid sheeting on the inner (traffic) face of the parapet. In addition the outer face must have sheeting to deny access to the outer ledge. It must be fitted at the ends of the vehicle parapet or on both sides of the railway tracks. Alternatively plain concrete parapet panels with a shaped non detachable coping achieve the same result.

In addition a safety barrier must be provided on each approach end of the vehicle parapet and on each departure end to prevent a vehicle from reaching the railway below, lengths of need are determined following a Road Restraint Risk Assessment Process (RRRAP).

There are a number of forms of bridges that can be considered. Table 3.2 below indicates the clear span, potential range in bridge deck depths and the construction type and material and a brief summary.

Single spans up to 60m can be achieved using traditional bridge construction. For larger single spans, the form of construction changes to more complex forms of either tied arch or cable stayed.

Table 3.2 Summary of Bridge Concepts by clear span

Spans	Typical Bridge Deck Depth Ranges	Bridge Type	Comments
< 37m	Overall deck depth range between 1.1m to 2.0m	Prestressed concrete beam with concrete deck	Easy to construct over railways Durable, reduced future maintenance
30-45m	Typical span to depth ratio ranging from 20 to 30 with 20 being most efficient design and 30 less efficient. For example, if the span is 30m the most efficient design would be 30/20 = 1.5m + 0.25m concrete topping + 0.25m surface = 2.0m to finished highway level. The least efficient design would be 30/30 = 1.0m + 0.25m concrete topping + 0.25m surface = 1.5m. For the purpose of this study we have assumed a span to depth ratio of 25.	Multiple Plate Girders with concrete deck	Economic for short to medium spans. Plate Girders fabricated from weathering steel reduces need to paint girders over railway
30-60m		Multiple steel box with concrete deck	Thick deck construction Stable under erection
50-150m	In reality as the span increase, so too will the number of vertical hangers although the spacing between vertical hangers would remain approximately the same. This would result in a broadly similar structural deck for the range of spans identified. However, the final thickness of design would be largely driven by the aesthetical appearance of the bridge in addition to its structural loading capacity. This is especially the case for the larger bridge spans. A multidisciplinary team of architects, planners and engineers would need to be involved in the design process to arrive at an appropriate bridge deck design.	Tied Arch with concrete deck	Thin deck construction reduces quantity of earthworks. Statement bridge, gives sense of identity Has structure visible above deck level
100-300m		Cable Stayed	Thin deck construction, reduces quantity of earthworks Statement bridge, gives sense of identity Has structure visible above deck level
>300m		Suspension	Used for longest spans where intermediate piers are not feasible. Needs firm ground or rock close to ground surface for foundations

The bridge foundations will need to be considered after site investigations have determined the soil properties at the specific crossing points. Previous reports indicate poor quality low strength soils, featuring layers of peat at the southern end of the site. If pad foundations are used then settlement would be an issue hence piled foundations are recommended however it is noted that at the southern end of the site there is the possibility of archaeological remains. In addition there is an aquifer beneath the site which cannot be punctured in the piling operations.

Given the low level of the surrounding ground and the height gain needed to cross the railway lines in all instances, it is expected that there will be significant amounts of fill imported to the site. In certain areas where the peat is found, it is expected that this would be removed and replaced with better quality fill and the ground would need to be surcharged to allow the ground to strengthen prior to final construction. This can take a substantial amount of time. Alternatively lightweight fill such as polystyrene blocks could be used to reduce the overall weight of the earthworks and the settlement of the embankments.

3.5 Summary

The York Central junction designs need to provide a safe and efficient means of access and egress for all mode of transport. The designs need to have an appropriate level of junction capacity and integrate with the surrounding transport network and built environment.

The access corridors will be 16.3m in width and adopt geometric design parameters consistent with the York Highway Design Guide for Local Distributor Roads.

Safeguarding of land for future transport needs, especially in the vicinity of the access junctions, will provide much needed flexibility given the range of factors which may influence transport demand over the lifetime of the York Central building programme.

The bridge designs need to provide simple crossing points of the rail network. As the crossings are over electrified railways, there are certain necessary requirements that need to be included. The parapets need to be a minimum of 1.5m high with solid infill and be anti-climb. If it is deemed that there is a vandalism problem then the height will need to be increased to 1.8m

The intention is to provide a family of structures to give a sense of identity with the York Central development rather than having a variety of bridge forms.

4 Chancery Rise (Access corridor A)

4.1 Introduction

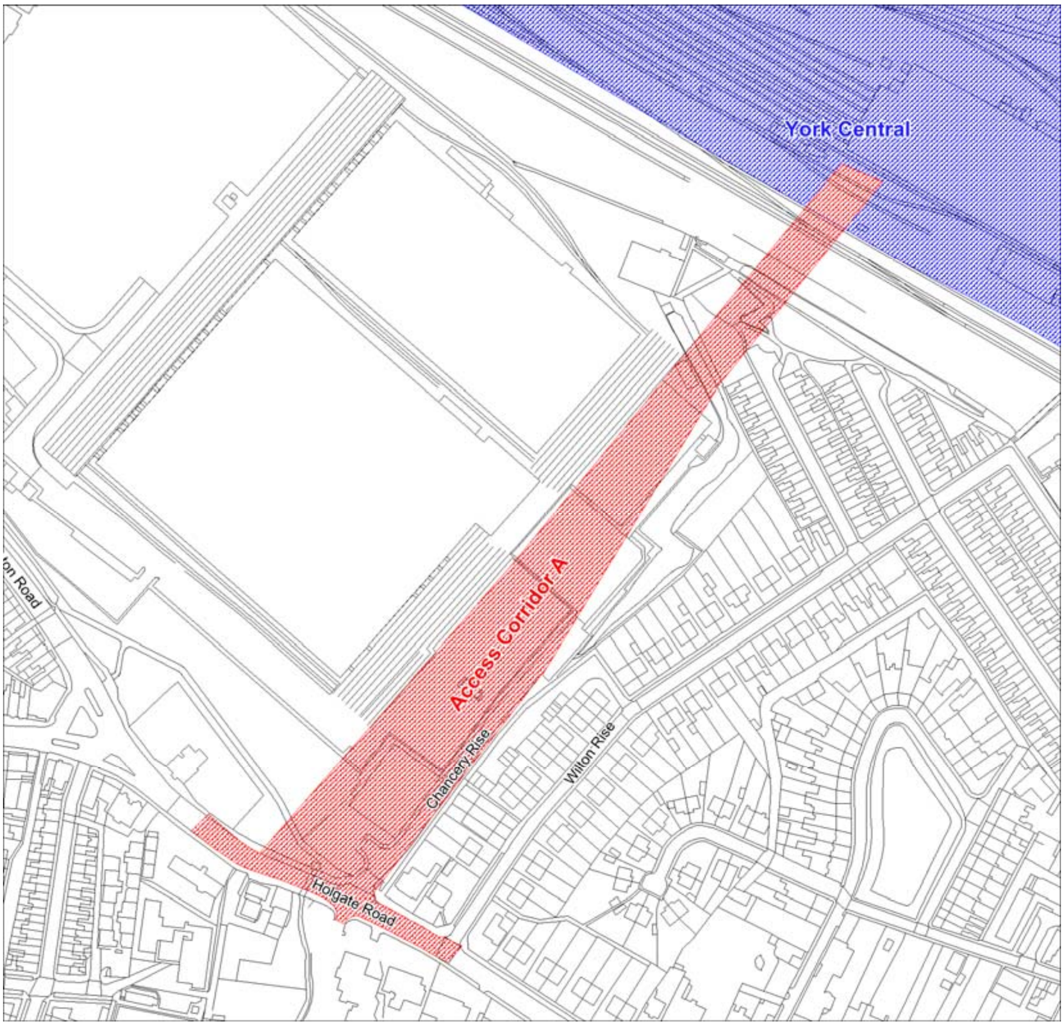
Chancery Rise could provide access to York Central from the A59 Holgate Road. The majority of the land available for the access corridor is under the ownership of Network Rail, Yorkshire Forward and the City of York Council.

This chapter examines the engineering feasibility of providing an access corridor via Chancery Rise into York Central. The chapter also considers the key design challenges, risks and examines the cost of the works and buildability issues.

For each of the Rail Land Options shown in Figure 1.2 and Appendix A there is a consistent boundary for the developable land within York Central. There is therefore only a requirement to consider one highway and bridge design solution.

Figure 4.1 below provides a location plan for the corridor.

Figure 4.1 Chancery Rise Location Plan (Access Corridor A)



4.2 Existing Situation

Chancery Rise forms a priority crossroads with the A59 Holgate Road as shown in Plate 4.1.

Plate 4.1 Existing Priority Crossroads at the Chancery Rise/Holgate Road junction

There is signal controlled crossing facility to the immediate west of the junction and a popular pedestrian and cycle route to the rear of the Fox Public House.

Chancery Rise is 6.8mwide with a 2m wide footway on its western side.

Chancery Rise is a cul-de-sac with the vacant Alliance House office accommodation and parking at the northern end. To the north of Alliance House is a play area with the FAL further north. The play area is some 6.8m higher than the A59 corridor.

The Thrall works are on the western side of the access corridor and there is a predominantly residential area on the eastern side.

To the south of the A59 Chancery Rise provides access to a private residential accommodation with parking for about 50 car parking spaces (estimated from Google Earth due to it being a private road).

On Holgate Road to the west is the Acomb Road and Poppleton Road traffic signal controlled junction. To the east Holgate Road rises with minor priority junctions and private driveways providing access to residential areas and private residences. Further east is the A1036 Tadcaster Road.

4.3 Junction Improvement

The existing priority junction whilst adequate to support the previous land uses is not an appropriate junction design given the anticipated level of travel demand which will use the access.

The position of the new junction and access corridor is largely dictated by an existing electric sub station 100m to the north of Holgate Road. We have assumed this sub station would remain as part of the works as they can be very expensive to relocate and it is feasible to accommodate the 16.3 access corridor, albeit with some relaxation of the standards, either side of the sub station.

An initial option investigated the access corridor on the eastern side of the sub station. This provided a four arm signal controlled junction with good alignments. Unfortunately the highway footprint required significant third party land outside numbers 148 to 152 Holgate Road. Figure 4.2 provides a record of the initial draft design and clearly shows the impact on the two commercial properties which are currently occupied.

Figure 4.2 Rejected draft design of the Chancery Rise junction improvement on the eastern side of the sub station

Requirement for third party land and demolition of existing properties to accommodate design

Such a significant requirement for third party land was deemed to be a major risk to delivery and the proposed access corridor was moved to the western side of the sub station. The resultant proposed design is presented on Drawing CTDAOB-002-001 in Appendix B. Some of the main design features are as follows:

- pedestrian and cycle crossing facilities to cater for all of the crossing movements
- integration of the existing signal controlled crossing facility on Holgate Road into the proposed junction
- the provision of dedicated left and right turns lanes into and out of York Central
- the potential for additional section of bus lane to the rear of the public house which can be seen as a ‘bolt on’ to the proposed bus lanes to be delivered as part of Access York Phase 1
- areas reserved for new landscaping to offset the loss of mature trees;
- the provision of an area reserved for future public transport priority or additional highway capacity leaving York Central

- cycle facilities in accordance with Cycling England guidelines with the exception of a dedicated right turn cycle lane on the Holgate Road eastern arm which is not feasible due to the width constraints

The anticipated performance of the junction has been tested in computer modelling software (LINSIG v.3) using the anticipated travel demand outlined in Chapter 2. Table 4.1 provides a summary of the results.

Table 4.1 - Capacity Assessment of the Chancery Rise traffic signal improvement option (2021 Flow Scenario)

Location	Time period	Degree of Saturation	Number of vehicle queuing
Holgate Road (West)	AM IP PM	71% 65% 55%	8 6 9
Chancery Rise	AM IP PM	42% 64% 91%	3 5 15
Holgate Road (East)	AM IP PM	87% 83% 91%	15 13 31

Table 4.1 shows that during the morning peak period the junction operates within the recommended design thresholds (defined as an arm where the degree of saturation > 85%). During the busier inter peak and evening peak periods the junction is operating close to or at its recommended design thresholds.

A further test has been undertaken with the forecast traffic levels into and out of York Central increased by 20%. The outputs of this assessment are presented in Table 4.2.

Table 4.2 - Capacity Assessment of the Chancery Rise traffic signal improvement option (2021 Flow Scenario +20% increase in development traffic)

Location	Time period	Degree of Saturation	Number of vehicle queuing
Holgate Road (West)	AM IP PM	75% 71% 63%	9 7 11
Chancery Rise	AM IP PM	51% 75% 97%	4 6 22
Holgate Road (East)	AM IP PM	89% 85% 98%	16 14 46

Table 4.2 shows deterioration in network performance with the associated increase in traffic levels. In this scenario queues and delays would be apparent especially during the inter peak and evening peak periods. The Holgate Road (east) approach arm and Chancery Rise would have substantial vehicle queues in this scenario.

An interim layout with a reduced footprint for the junction works has been tested. This option assumed Holgate Road west approach was a single lane with no dedicated left turn lane into York Central. This substantially reduces the impact on the existing tree line. Table 4.3 summarises the results of this assessment.

Table 4.3 - Capacity Assessment of the Chancery Rise traffic signal improvement option with interim layout (2021 Flow Scenario with 25% decrease in development traffic)

Location	Time period	Degree of Saturation	Number of vehicle queuing
Holgate Road (West)	AM IP PM	80% 74% 53%	14 13 11
Chancery Rise	AM IP PM	41% 63% 89%	3 4 11
Holgate Road (East)	AM IP PM	80% 76% 90%	17 15 33

Table 4.3 shows that traffic levels would need to be reduced by approximately 25% in order for this design to provide a suitable junction performance. This assessment also allows us to conclude that there is an interim design solution at this location which could support 75% of the masterplan proposals before the dedicated left turn lane is provided.

A second junction improvement option has been developed which proposes a roundabout. The scheme design is presented on Drawing CTDAOB002-004 in Appendix B. The scheme has advantages over the traffic signal controlled option in that the design shows no requirement for third party land near to The Fox PH and the design can more readily accommodate the integration of the Chancery Rise (southern arm) which is a design risk with the signal controlled layout. Issues with this design include a reduced ability to coordinate traffic movements with the neighbouring traffic signals at the Acomb Road/Poppleton Road junction and less controlled crossings for pedestrians and cyclists.

The junction performance with the roundabout option has been tested using ARCADY software. The results of which are presented in Table 4.4.

Table 4.4 - Capacity Assessment of the Chancery Rise Junction with the roundabout improvement (2021 Flow Scenario)

Location	Time period	Degree of Saturation	Number of vehicle queuing
Holgate Road (West)	AM IP PM	68% 65% 60%	2 2 2
Chancery Rise	AM IP PM	33% 48% 56%	1 1 1
Holgate Road (East)	AM IP PM	72% 71% 97%	3 3 17

The results presented in Table 4.4 indicate the junction will perform within the recommended design thresholds for the morning and inter peak periods this is demonstrated by the degree of saturation figures which are below the recommended 85% design threshold. In the evening peak period a queue is predicted to form on the eastern arm of Holgate Road as traffic volumes increase on this arm in the evening rush hour. This problem can be mitigated by reducing traffic volumes leaving York Central site either through less intensive development or by increasing the mode share by sustainable modes.

4.4 Access corridor

The access corridor is presented on Drawing CTDAOB002-002 in Appendix B.

The length of the new access corridor is approximately 590m and is divided into two sections.

The first section, some 420m in length, commences at existing ground levels to connect in to the new traffic signal controlled junction and continuing at ground levels for approximately 180m before rising to the higher levels at the north behind Alliance House.

At the above point, some 225m from the junction, the access corridor begins to rise at a maximum gradient of 6% in order to cross the Freight Avoiding Line with a minimum clearance of 5.8m. The access corridor would then continue over the rail lines by means of a bridge before terminating at an elevated roundabout type junction within the Rail Land Options 1 to 6.

The second section of the access corridor, totalling 170m in length, continues from the roundabout (30m diameter) and would then ramp down at maximum gradient of 6% to reach existing ground levels and is shown continuing to the east on Drawing CTDAOB002-002. There is scope to also include an access corridor continuing to the west from this junction, to connect to proposals from Water End and to access other areas of the developable land available.

As illustrated on the plan drawing, extensive landscaping is proposed to the eastern aspect of the access corridor. This is proposed as a mitigation measure, to soften the visual aspect between Wilton Rise/ Cleveland Road and the access corridor. It may also assist with enhancing the air quality in this area.

Along the first section of the access corridor, the eastern edge would be supported by means of an embankment and to the west it would largely be supported by a retaining structure in order to avoid the need for earthworks that would otherwise conflict with the position of the Rail Traverse.

The roundabout is shown elevated and is supported by a retaining structure to its western and northern perimeter in order to maximise development land opportunities. A similar elevated roundabout in close proximity to a rail line has recently been constructed at the Cannon Park development in North Middlesbrough. Plate 4.2 shows the elevated roundabout at this site and the associated link road.

Plate 4.2 Elevated Roundabout under construction at the Cannon Park development in North Middlesbrough

An alternative embankment construction outline is shown on Drawing CTDAOB002-002.

The second section of the access corridor is shown on embankment construction over its entire length, but could equally be supported by a retained structure or pier supported ramp. These latter two options would again increase the area of developable land available.

The vertical profile as presented on Drawing CTDAOB002-003 in Appendix B. This illustrates the elevation of the access corridor (shown in a continuous red line) above existing ground levels (shown in a dashed green line) and also gives details of the vertical design features (gradients, vertical curve radii and lengths of gradients and curves).

This drawing importantly demonstrates that the access corridor meets the elevated existing ground levels in the vicinity of Cleveland Road, thereby minimising earthworks operations in this area and reducing the impact upon the adjacent housing. The elevation of No 22 Cleveland Road has been shown on the long section to demonstrate this. As will be noted more prominently in plan (refer to Drawing CTDAOB002-002) the eastern perimeter of the access corridor would be cut slightly in to the existing ground at this particular location and constructed on embankment on the western perimeter.

This type of profile, reducing in elevation away from Cleveland Road, means that the corridor will be have less visual intrusion upon the neighbouring residential properties compared to one that rises moving away. Screening, through landscaping or fencing would also further reduce the visual impact of this corridor.

Street lighting for this corridor may have an adverse impact on the properties to the western side of Cleveland Road, particularly at the northern end where the elevation of the corridor is similar to existing ground levels. Careful consideration of the location of the new street lights and street light types will be required in order to reduce glare in respect of these properties.

The existing playground to the north of Alliance House that connects to Cleveland Road and Upper St. Paul's Terrace will obviously be lost under this access corridor and should ideally be re-provided in the local area

An access from the access corridor to the footpath networks at the above location has been included.

The access corridor would require the demolition of a number of buildings including Alliance House and associate outbuildings (currently a vacant business premises) and the large rail workshop building to the north east of Alliance House within the Network Rail land and all associated outbuildings.

It should be reiterated that due to the chosen alignment of this access corridor, that the electricity substation on Chancery Rise does not need demolishing, which avoids the need for extremely costly works.

4.5 Bridge Design

The bridge design is shown on Drawing CTDAOB002-005 and is attached to Appendix B of this report.

At the proposed crossing point, of the three railway tracks, the clear span is 23m. The crossing can be achieved with no skew which minimises the overall span of the bridge. The proposed deck construction would comprise of 16 No. precast prestressed concrete beams, 14 No. 'M7' beams internally and two No. 'UM7' beams at the deck edges. Beams would be spaced at 1000mm centres. An insitu reinforced concrete deck slab of circa. 200mm thick would be cast over the beams on to permanent formwork soffit panels. The insitu deck concrete would be cast to form an integral structure with the abutments. Due to the adoption of standard prestressed bridge beams, a slight adjustment to the overall footway widths would be required to make best use of the beam sizes and spacing. The proposed bridge has a deck depth to finished road levels of around 1.67m, which is less than the 2 metre depth initially assumed. Although this would be subject to a more detailed levels survey (Refer to Table 4.4 for Scheme Risks) the implications of this maybe that the link road elevation reduces marginally at the detailed design stage as would the volume of earth embankments/retaining structure and land take.

Parapets would comprise of precast concrete high containment units attached to the main body of the deck slab with a bolted or dowelled joints. Parapets would be provided to a minimum height of 1,500mm above the adjacent carriageway/ footway level.

The outer face of the parapet units could incorporate a detail panel of a ribbed or exposed aggregate finish which would detract from the bland appearance of an otherwise blank concrete wall.

Abutments would comprise of reinforced concrete stem cantilever units structurally connected to the deck to form an integral bridge. At their base, the abutments would merge into a reinforced concrete pile cap. Piles are expected to be continuous bored cast in situ reinforced concrete. This type of pile provides a seal to the surrounding soils and restricts the amount of groundwater flow.

Services zones can be created in the spaces between the concrete beams.

Some of the benefits of this type of construction at this location are:

- Bored cast insitu piles reduce the risks of ground heave and vibration on the adjacent railway during their installation.
- Forming the abutments and deck slab as an integral bridge will reduce any future maintenance issues with bridge bearings and reduce the need for access onto the rail infrastructure beneath the structure.
- The use of precast concrete beams will minimise future maintenance requirements for the deck slab soffit. Being manufactured in a controlled factory environment they are very durable elements.
- The use of precast bridge beam units will reduce the night time possessions required to construct the bridge deck. Particularly important in this case as the structure is located immediately adjacent to residential properties.
- Deck construction can continue outside of possessions, during daytime working, once the precast concrete bridge beams and permanent formwork panels are in place.

4.6 Preliminary Scheme Costs

The preliminary scheme costs for the works are presented in Table 4.3. Optimism bias of 44% has been applied to the scheme costs based on guidance issued by the Department for Transport. A detailed breakdown is provided in Appendix G.

.

Table 4.3 Estimated Scheme Costs for Access corridor A (2011 Prices)

Description	Cost (£)
Junction Improvement (traffic signals)	353,255
Junction Improvement (roundabout within York Central)	214,230
Access corridor	3,851,050
Bridge	1,818,832
Archaeology	125,235
Sub total (including General preliminaries, design and supervision costs and contingencies)	6,362,602
Optimism Bias (@ 44%)	2,799,545
Total	9,162,147

4.7 Design and Project Risks

The junction works will impact on the Holgate Beck culvert which will either need to be relocated or protected as part of the junction improvement works.

The works will also impact on a series of mature trees and although they are not subject to a Tree Preservation Orders (TPO) as shown in Figure 4.3 their removal will be a sensitive issue. Figure 4.4 below denotes the position of the trees with the indicative position of the new kerb line (for the traffic signal controlled layout) in red outline.

Figure 4.4 Location of mature and semi mature trees affected by the junction improvement

The traffic signal controlled junction design requires some third party land from part of the existing car park for the Fox PH. Further work will be needed to establish a more accurate estimate of the land required with the exact requirements confirmed on receipt of a more detailed Masterplan for York Central. Impacting on the Public House is not anticipated as part of the works but should be avoided on cost grounds and its listed building status as shown in Figure 4.2.

The incorporation of Chancery Rise (south) into the traffic signal controlled layout is a cause for concern given the proximity of the access point to the traffic signal stopline. Further investigations need to be undertaken to examine traffic movements via this access and the feasibility of combining this access with the alternative access 20m to the east or alternatively moving the access to the west so it can be more readily combined within the signal controlled layout. Moving it to the west is preferable although this will result in the loss of some mature trees and further protection works to the Holgate Beck Culvert.

The existing access corridor position depends on being able to align this route between the Rail Traverses and the existing electric substation. If there are any onerous requirements in terms of clearance to the latter, without significant departure in design standards, or relocation of the sub-station, this particular route may become untenable.

The position of the access corridor at the northern end of its route depends on being able to secure the land currently used as a playground and being able to relocate that facility somewhere else local for the community.

It is assumed that no third party land is required between the boundary of developable land provided and the existing playground or between the playground and the land owned by Network Rail.

The bridge concept is based on the rail levels of the adjacent siding tracks. No level information is currently available for the Freight Avoidance Lines. However, from a site inspection it would appear that the risk of the rails being significantly higher than assumed is minimal. To accommodate some variation to the actual FAL levels, additional headroom of 200mm has been allowed.

On further site surveys and development of the design, the initial concept proposal can be value engineered to reduce road level whilst maintaining the required headroom. This could reduce the approach gradients and extent of earthworks

The concept is based on the current position of the rail tracks. If future slewing of the tracks or additional tracks are added, then the proposal may no longer be suitable.

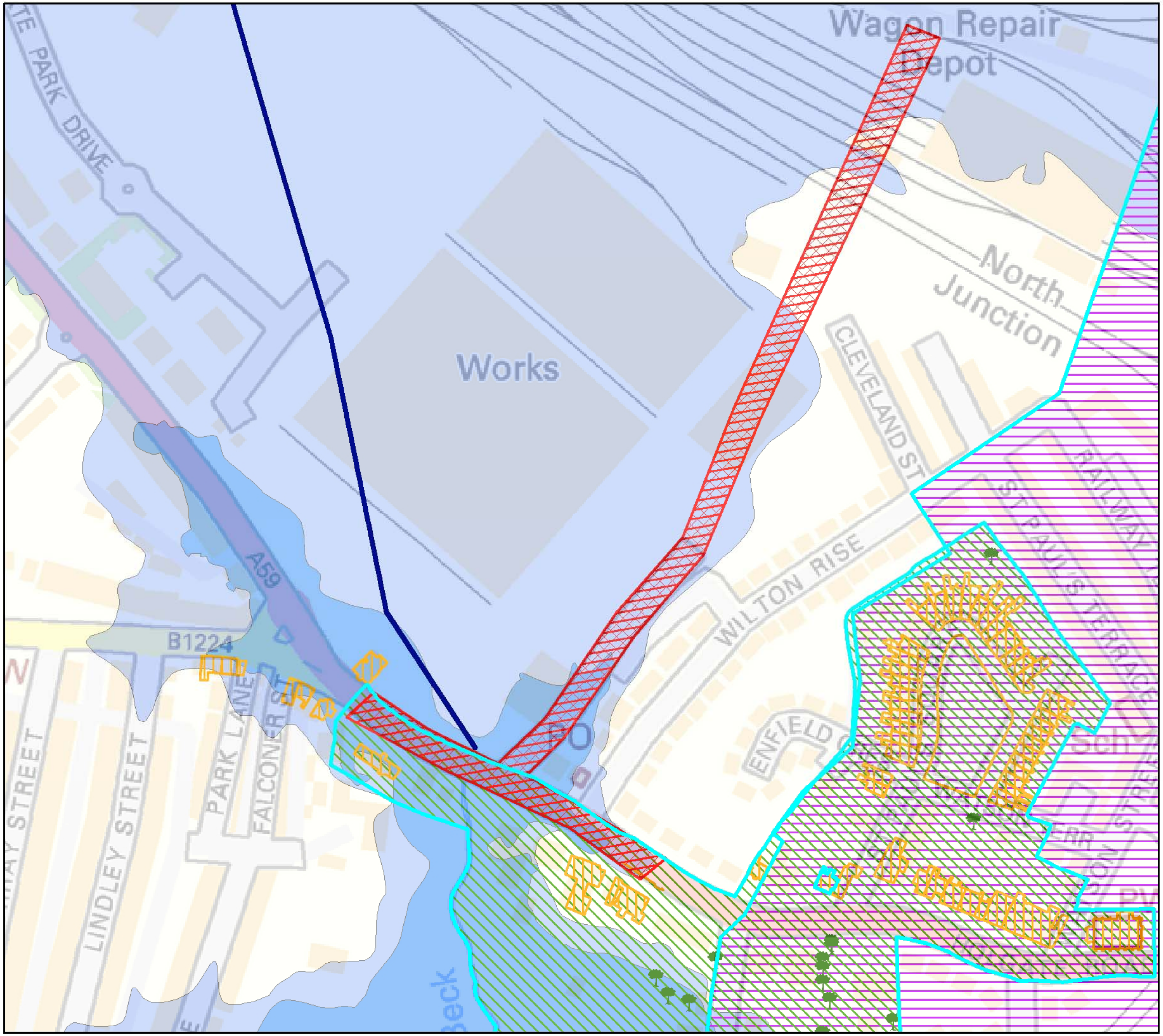
No consideration has been made to the possible effects the structure may have on Network Rail's signalling infrastructure. If sighting distances are reduced/ impaired, re-signalling works may need to be undertaken.

Piled foundation details are indicative at present, a site investigation local to the final bridge's location would provide accurate assessment of the ground conditions. From previous site investigation reports undertaken in and around the site it is understood that there are peat and highly compressible soil layers in the vicinity. A piled solution therefore seems likely at this point.

The southern part of the site is noted in previous site investigations as being archeologically significant. On site archaeological investigations may create delays and place restrictions on the site.

An investigation into the presence of any utility service providers' buried infrastructure has not been made at this stage. Service diversions may be required following this activity.

A summary of the principal project risks is provided in Table 4.4 and provides a useful table for further scheme development.



Legend

- Existing Culvert
- Access Option A
- Tree preservation order
- SINC area
- Scheduled Ancient Monument
- Listed Buildings
- Conservation Areas
- Areas Of Archaeological Importance

SFRA Flood Zones

zone

- 1in1000
- 1in100 Nodefences
- 1in100 Withdefences 1/100
- 1in100 Withdefences 1/50
- 1in25 Developed Areas
- 1in25 Nodefences

CITY OF YORK COUNCIL

Halcrow Group Ltd
Arndale House
Otley Road
Headingley
Leeds
LS6 2UL

Halcrow

York Central Bridge Engineering Study Access Corridor A Site Constraints

Figure 4.3

Drawn by: Pam Murray

Date Drawn: 15/03/2011

Table 4.4 Summary of principal design and project risks (access corridor A)

Risk	Likelihood (Scale 1 to 5, where 1 is low probability 5 is high probability)	Impact (Scale 1 to 5 where 5 is high impact and 1 low impact)	Score	Mitigation
Proximity of the access corridor to residential properties. Strong local objections to scheme.	5	4	20	Instigate further design and assessment work to quantify impact and identify mitigation measures
Planning issues associated with the relocation of the existing play area	5	3	15	Investigate alternative for the play area. Possibly using the land adjacent to the access corridor.
Scheme affects utility apparatus	5	3	15	Instigate requests from utilities to understand what apparatus maybe affected by the works. Proceed
Proposed foundation design provide insufficient load bearing capability	3	4	12	Instigate surveys in the vicinity of the bridge and embankment
Scheme effects Network Rail signalling equipment	3	3	9	Instigate early consultation with Network Rail to establish signalling requirements for the FAL and Engineers triangle
Negotiations fail with stakeholders/landowners on the Chancery Rise. Fail to find appropriate design for the Chancery Rise access.	3	3	9	Undertake further design work investigating the local access issues. Look for early resolution on design. Instigate consultation with Environment Agency and landowners. Submit design for Road Safety Audit. Alternatively adopt roundabout design.
Scheme does not receive necessary approvals due to the impact on the trees	3	2	6	Instigate early consultation with landscape officer and arboriculture officers. Incorporate extensive landscaping within the final design to offset the loss.
Scheme does not have sufficient clearance of the FAL	2	3	6	Undertake detailed levels survey on the FAL and areas affected by the link road prior to detailed design stage.
Negotiations fail for acquiring third party land from the Fox PH	2	2	4	Further design and capacity assessment to provide more robust estimates on land take requirements. Instigate liaison with landowner at earliest timescale. Alternatively adopt roundabout design.
Mitigation/protection of Holgate culvert delays site works or costs more than anticipated	2	2	4	Instigate early consultation with the Environment Agency.
Areas of archaeological interest	2	2	4	Early consultation with archaeological stakeholders
Issues associated with the demolition of the existing buildings (hazardous materials)	4	1	4	Instigate further work to examine demolition issues e.g hazardous materials
Working areas for the construction of the highway e.g proximity to Rail Traverse 1	3	1	3	Establish construction phasing and working areas

4.8 Buildability Assessment

The construction of either option for the proposed junction improvement do not present any significant obstacles other than what would normally be typically experienced for improvement works on a major arterial route.

The availability of land under the ownership of the York Central stakeholders in the vicinity of the works will improve the ease of construction. Furthermore, the land to the south east of the access corridor would be suitable for a contractor's compound in addition to their main compound which will be in York Central site.

There are adequate working areas for the construction of the access corridor for the majority of its length. Space available for a working area will be an issue around Rail Traverse 1 although such constraints are not uncommon for highway works in a built environment.

A significant proportion of the access corridor would be constructed at existing ground levels on land that appears currently to be used for car parking. At the northern end of the corridor, demolition of Alliance House could result in potential material for embankment construction and / or carriageway foundation material.

Works adjacent to Cleveland Road are in close proximity to the house and would require careful engineering to ensure no disturbance to this property arises from construction work, but again this does not pose a significant issue.

As this access corridor is not an existing access to any property or other through routes, construction activity would not cause and traffic management issues.

The construction of the proposed bridge included in the Access A corridor, does not pose any significant or unusual engineering problems. Although the usual difficulties and restrictions of working adjacent to overhead electrified railway lines and in close proximity to populated urban areas will exist.

Access to the bridge site would be gained on the southern side following the demolition of Alliance House and using the access afforded by the new road construction. Access to the northern side would be gained using the existing access points from Leeman Road.

Works adjacent to live railways and the overhead electrified lines are inevitable with this or any other form of structure provided at this location. The establishment of site boundaries, the piling operation, excavation for the pile caps, the erection of temporary works to form the abutments and the deck construction will all require the contractor to work closely with Network Rail. All works will require Network Rail's prior approval, the use of pre-booked possessions and isolations of the Over Head Line Equipment.

The use of precast concrete beams to form the bridge deck will reduce the possessions and isolations required. This is particularly important when undertaking construction activities at night in close proximity to residential properties.

The construction of the highway in York Central does not present any major issues.

4.9 Summary

This chapter has examined the engineering feasibility of constructing a new access into York Central via Chancery Rise.

To provide an access at this location requires a substantial junction improvement, construction of a new highway and a 23m bridge over the Freight Avoiding Line and engineer's triangle. On entering York Central a 170m highway is required to ramp down to the existing ground level within York Central.

The estimated cost of the works is approximately £9.2million in 2011 prices.

As there is a consistent boundary for each of the rail land options identified by CYC there is no difference in cost between Rail Land Options 1 to 6.

The preliminary investigation and design work does not indicate there to be any major engineering issues associated with the access corridor.

The major risks to the access corridor are planning issues with the proximity of the corridor to residential dwellings and the relocation of the play area.

There are no major construction issues associated with the scheme.

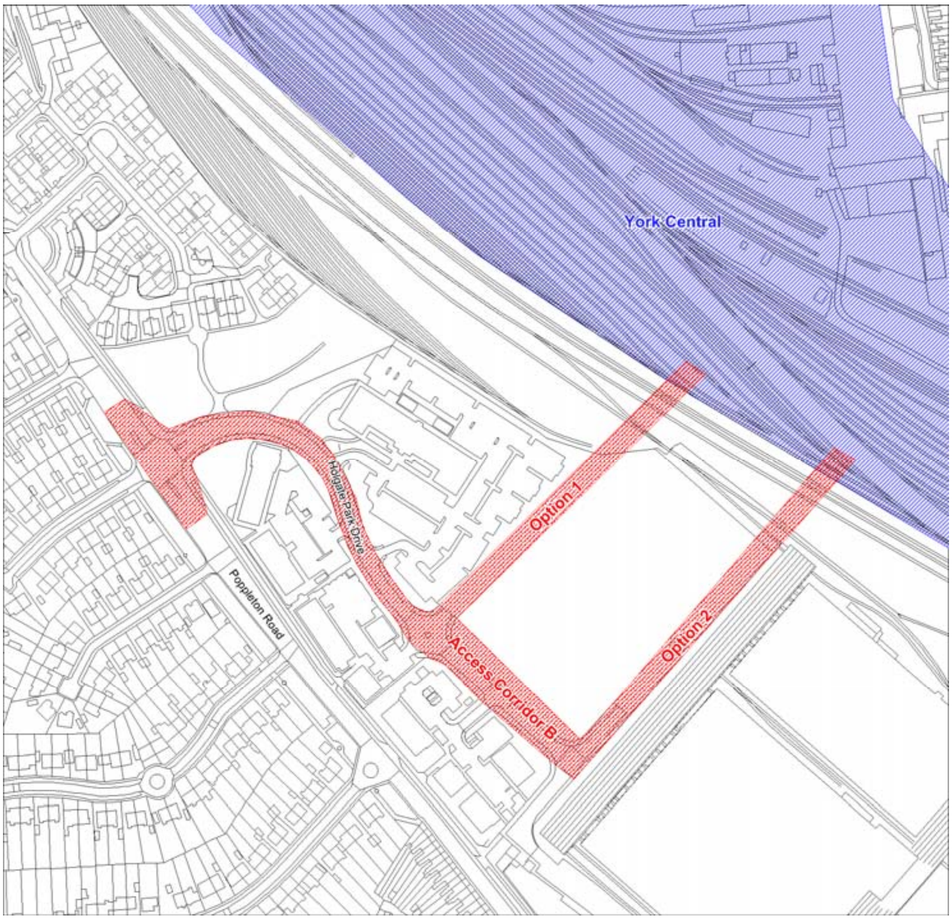
5 Holgate Park Drive (Access corridor B)

5.1 Introduction

An access to York Central via Holgate Park Drive was initially identified by Alan Baxter Associates in 2001 and further work was undertaken by Faber Maunsell in 2005 as part of a previous York Central traffic study. The remainder of this report provides an update to the earlier work. Moreover this section of the report examines the engineering feasibility of the bridge and highway alignments for the rail land options 1 to 6, which at this location impose significant challenges for the highway and bridge engineering solutions.

Figure 5.1 below provides a location plan and shows the two options available for crossing into York Central.

Figure 5.1 Holgate Road Access Corridor Options (Access Corridor B)



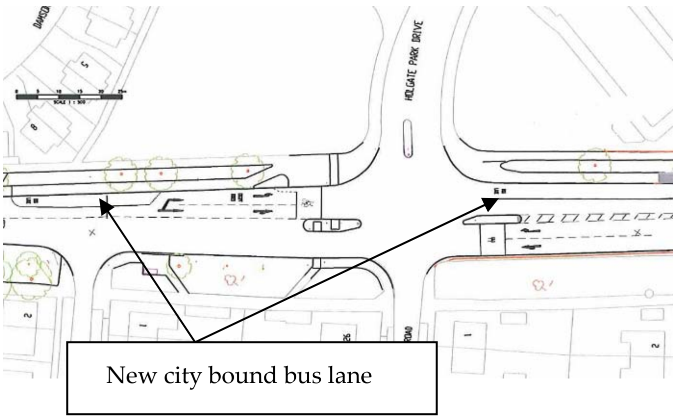
5.2 Existing Situation

Holgate Park Drive forms a four arm signal controlled junction with the A59 Poppleton Road and Tisbury Road. The existing junction layout was implemented as part of the S278 works for the office accommodation on Holgate Park Drive. It is this area which will be explored as a means of access into York Central.

Plate 5.1 Existing Traffic Signal Controlled junction at Holgate Road Drive/A59 Holgate Road Junction

Works are programmed for the junction as part of the Access York Phase 1 scheme. Figure 5.2 shows the scheme proposals which include a new bus lane leading into York City Centre. Previous traffic modelling for the corridor indicated this improvement did not affect the junction performance to any significant degree.

Figure 5.2 Access York Phase 1 Proposals for the Holgate Park Junction



Holgate Park Drive is 7.3m wide and has adjacent use pedestrian and cycle footways although no dedicated on highway cycle lanes. During normal working hours Holgate Park Drive is used as overspill parking for the office accommodation and this affects the quality of the route for pedestrians, cyclists and vehicles. Plate 5.2 shows parking issues on the route during office hours.

Plate 5.2 Parking issues on Holgate Park Drive

There is a large area of undeveloped land between the office buildings and the Trinity Thrall Works. This is commonly referred to as the 'Five Acre site' and is owned by Yorkshire Forward. It is this area which will be used as a means of access into York Central. The highways masterplan for Holgate Park Drive has acknowledged this potential and provided a four arm roundabout on the western side of the Five Acre site as shown in Plate 5.3. On the eastern side of the Five Acre site there is a priority junction which is shown in Plate 5.4. This location could also provide a means of access into York Central.

Plate 5.3 Existing four arm roundabout on Holgate Park Drive with available spur which could provide access into York Central

Available roundabout spur into York Central

Plate 5.4 Existing Priority Junction at the eastern end of Holgate Park Drive with the Thrall works in the background

5.3 Junction Improvement (Holgate Park Drive/A59 Poppleton Road)

The performance of the existing Holgate Park Drive/A59 Poppleton Road has been tested using the LINSIG software using the traffic forecasts presented in Chapter 2. The results of the analysis are presented in Table 5.1.

The analysis shows that during all three time periods the junction is operating close to or at full capacity. Key arms which are operating at full capacity include the A59 (north) ahead and right turn manoeuvre and the A59 (south) right turn manoeuvre into the development site. The capacity of the Holgate Park Drive right turn exit in the evening peak is also operating at full capacity.

This capacity analysis demonstrates that the existing junction can accommodate the additional transport demand albeit with additional queues and delays. However, the level of delays and congestion is comparable to many other junctions in the city and substantially lower than critical junctions either further south and north on the A59 corridor (A59/Water End and at A59/Acomb Road).

Further detailed assessments will need to be undertaken on completion of the Masterplan proposals but for the purposes of this initial assessment we have concluded that no civil works are necessary over and above those being delivered as part of the Access York scheme. There is scope to widen the carriageway into the grass verge on the northern side of Poppleton Road if further work concluded significant additional capacity was necessary. There is also scope to provide Urban Traffic Management and Control initiatives at this particular location in order to get the most capacity from the existing layout. These could include CCTV traffic monitoring cameras, the introduction of more advanced signalling equipment and changes to the traffic signal staging which is currently very rigid.

Table 5.1 - Capacity Assessment of the Holgate Park Drive / A59 Holgate Road Junction (2021 Flow Scenario)

Location	Time period	Degree of Saturation	Number of vehicles queuing
A59 (North) left turn	AM IP PM	70% 78% 74%	10 10 10
A59 (North) ahead & right turns	AM IP PM	88% 89% 86%	18 15 16
Holgate Park Drive (left turn)	AM IP PM	32% 42% 58%	5 6 10
Holgate Park Drive right turn	AM IP PM	80% 81% 87%	5 6 11
A59 (South) ahead & left turns	AM IP PM	44% 49% 80%	8 7 16
A59 (South) right turn	AM IP PM	87% 90% 84%	13 12 9
Tisbury Road (all movements)	AM IP PM	4% 2% 4%	<1 <1 <1

5.4 Junction Improvements (Holgate Park Drive)

Using the existing roundabout spur shown in Plate 5.3 as means of access to York Central will substantially change traffic flows. To accommodate the change in flows the footprint of the roundabout will need to be enlarged so that it will have a raised island in the centre of the roundabout. This will prevent turning vehicles from overrunning the central island, improve the deflection angles and reduce vehicle speeds.

The priority controlled junction shown in Plate 5.4 at the eastern end of Holgate Park Drive will also need to be modified if the access corridor is on the eastern side of the Five Acre site. The provision of a new roundabout with a diameter of at least 30 metres is required.

For both of these roundabout improvement options there is no requirement to undertake a traffic capacity assessment of the design given the skewed nature of traffic movements which will be prevalent at both locations.

5.5 Access corridor Options

From the A59/Holgate Park Drive traffic signals the access corridor would use the existing Holgate Park Drive. To improve accessibility on this section of the corridor waiting restrictions will be required in order to address the parking issues. The introduction of the waiting restrictions may need to be pursued in combination with a travel planning campaign in order to address car commuting to the office blocks.

The differing Rail Land Options discussed in Section 1.3 of this report, present alternative options for crossing the railway line sidings and FAL from the Five Acre Site. Rail Land Options 1 to 5 present a longer crossing than in Scenario 6. The land available within the Five Acre site presents two further potential access corridors linking to the existing highway junctions within the Business Park. The first of these corridor options, referred to hereafter as Access B1, considers use of the junction at the south eastern corner of the site adjacent to the Traverse Table, west of the Thrall Works. The second corridor option, referred to hereafter as Access B2, considers use of the roundabout junction at the south western corner of the site, from within the Business Park.

For each of the two access corridors, Access B1 and B2, two routes have been proposed showing how the corridor can be routed into the available land with York Central, presenting a simple corridor route and an alternative terminating at a roundabout junction similar to the Cannon Park arrangement shown in Plate 4.3.

A summary of the options available is summarised below:

- Access corridor B1, Land Use Scenario 1 to 5, Option A without Roundabout
- Access corridor B1, Land Use Scenario 1 to 5, Option B with Roundabout
- Access corridor B2, Land Use Scenario 1 to 5, Option A without Roundabout
- Access corridor B2, Land Use Scenario 1 to 5, Option B with Roundabout
- Access corridor B1, Land Use Scenario 6, Option A without Roundabout
- Access corridor B1, Land Use Scenario 6, Option B with Roundabout
- Access corridor B2, Land Use Scenario 6, Option A without Roundabout
- Access corridor B2, Land Use Scenario 6, Option B with Roundabout

Access corridor B1, Land Use Scenario 1 to 5, Option A without Roundabout

This option presented as Drawing CTDAOB003-001 in Appendix C provides a corridor of approximately 420m and follows the eastern side of the Five Acre development plot before bridging over the sidings and FAL at the northern side of the site. It then curves after crossing the rail infrastructure, continuing eastwards into the Network Rail site. This type of configuration, whilst adhering to the design standards set out earlier, is more consuming in term of land use and severance of the site. It would also require a priority or signalised junction in order to connect to an access corridor from Water End or to the western portion of the site.

The corridor would commence at the existing reconfigured junction at the eastern end of Holgate Park Drive and be aligned to avoid an existing electric sub station before continuing towards and over the sidings and FAL. In order to achieve the required 5.8m clearance over the sidings and then the FAL, the access corridor begins to rise almost immediately to achieve a maximum gradient of 6%. The access corridor would then continue over the rail lines by means of a bridge before ramping down at maximum gradient of 6% to reach existing ground levels.

The section of the access corridor adjacent to the Thrall Works Traverse and north of the Electric Sub station would require partial support by means of a retaining structure, curtailing an earth embankment to avoid encroachment on to the Traverse.

A maintenance access to serve the existing electric substation would be required as shown on Drawing CTDAOB003-001 in Appendix C. Due to the elevation of the access corridor at this location, to rise over the sidings, a retaining structure would be required around the electric substation and between the maintenance access road and the access corridor.

All other elevated sections of the access corridor could be supported by embankments.

The vertical profile as presented on Drawing CTDAOB003-002 in Appendix C illustrates the elevation of the access corridor (shown in a continuous red line) above existing ground levels (shown in a dashed green line) and also gives details of the vertical design features (gradients, vertical curve radii and lengths of gradients and curves).

This access corridor would not require the demolition of any buildings within the Five Acre site, but would ultimately require demolition works within the York Central Site.

As illustrated on the plan drawing, a reasonable level of landscaping could be provided to the embankments which would assist in screening the access corridor from Holgate Park Drive.

Access corridor B1, Land Use Scenario 1 to 5, Option B with Roundabout

This option presented as Drawing CTDAOB003-003 in Appendix C provides a corridor of similar length to the previous route at approximately 430m and follows the same route as access corridor B1 Option A for these Rail Land Options but terminates on the north side of the FAL in the form of an elevated roundabout, approximately 30m in diameter. This arrangement has the advantage over Option A of being more compact in terms of landtake and provides a more convenient junction to link to an access corridor from Water End or to the western portion of the site.

As with Option A above, the corridor would commence at the reconfigured junction at the eastern end of Holgate Park Drive and be aligned to avoid an existing electric sub station before continuing towards and over the sidings and FAL. In order to achieve the required 5.8m clearance over the sidings and then the FAL, the access corridor begins to rise almost immediately to achieve a maximum gradient of 6%. The access corridor would then continue over the rail lines by means of a bridge before ramping down at maximum gradient of 6% to reach existing ground levels.

The section of the access corridor adjacent to the Thrall Works Traverse and north of the electric substation would require partial support by means of a retaining structure, curtailing an earth embankment to avoid encroachment on to the Traverse.

A maintenance access to serve the existing electric substation would also be required for this Option, as shown on Drawing CTDAOB003-003 and again require a retaining structure around the electric substation and between the maintenance access road and the access corridor.

All other elevated sections of the access corridor could be supported by embankments.

The vertical profile as presented on Drawing CTDAOB003-004 in Appendix C illustrates the elevation of the access corridor (shown in a continuous red line) above existing ground levels (shown in a dashed green line) and also gives details of the vertical design features (gradients, vertical curve radii and lengths of gradients and curves).

This access corridor would not require the demolition of any buildings within the Five Acre site, but would ultimately require demolition works within the York Central site.

As illustrated on the plan drawing, a reasonable level of landscaping could be provided to the embankments which would assist in screening the access corridor from Holgate Park Drive. In order to minimise landtake the roundabout junction could be supported in its elevated position by means of a retaining wall or pier. Alternatively it could also be supported with an embankment as illustrated by the dashed green line on plan on drawing CTDAOB003-003.

Access corridor B2, Land Use Scenario 1 to 5, Option A without Roundabout

This option presented as Drawing CTDAOB003-005 in Appendix C provides a corridor of approximately 400m and follows the western side of the Five Acre development plot before bridging over the sidings and FAL at the northern side of the site. It then curves after crossing the rail infrastructure, continuing eastwards into the Network Rail site. As with access corridor B1 Option A for these Rail land Options, this type of configuration adheres to the design standards set out earlier, but is more consuming in term of land use. Again, it would require a priority or signalised junction in order to connect to an access corridor from Water End or to the western portion of the site.

The corridor would commence at the existing roundabout junction within the middle portion of Holgate Park Drive which would be reconfigured, remaining as far to the west of the Five Acre site as possible in order to maximise remaining land use in this site. In order to achieve the required 5.8m clearance over the sidings and then the FAL, the access corridor begins to rise almost immediately to achieve a maximum gradient of 6%. The access corridor would then continue over the rail lines by means of a bridge before ramping down at maximum gradient of 6% to reach existing ground levels.

On the western side of the access corridor approach a retaining wall is required in order to avoid encroachment of the embankment into the parking areas.

After crossing the railway lines, the access corridor is proposed close to the northern boundary of the available parcel of land. In order to keep the highway alignment within the land parcel of these Rail Land Options a 60m of horizontal radius curve is proposed. As the route continues eastward a retaining wall is required to ensure that the earthwork embankments do not encroach on the rail infrastructure. All other elevated sections of the access corridor could be supported by embankments.

The vertical profile as presented on Drawing CTDAOB003-006 in Appendix C illustrates the elevation of the access corridor (shown in a continuous red line) above existing ground levels (shown in a dashed green line) and also gives details of the vertical design features (gradients, vertical curve radii and lengths of gradients and curves).

This access corridor would not require the demolition of any buildings within the Five Acre site, but would ultimately require demolition works within the York Central site.

As illustrated on the plan drawing, a reasonable level of landscaping could be provided to the embankments which would assist in screening the access corridor from any future development in the Five Acre site, but not to Holgate Park Drive.

Access corridor B2, Land Use Scenario 1 to 5, Option B with Roundabout

This option presented as Drawing CTDAOB003-007 in Appendix C provides a corridor of similar length to the previous route at approximately 460m and follows the same route as access corridor B2 Option A for these Rail land Options but as terminates on the north side of the FAL in the form of an elevated roundabout, approximately 30m in diameter. This arrangement has the advantage over Option A of not requiring a retaining structure along the northern side of the access corridor within the York Central site. It also provides the only tenable solution to connect to an access corridor from Water End or to the western portion of the site.

As with Option A above, the corridor would commence at the existing roundabout junction within the middle portion of Holgate Park Drive which would be reconfigured, remaining as far to the west of the Five Acre site as possible in order to maximise remaining land use in this site. In order to achieve the required 5.8m clearance over the sidings and then the FAL, this access corridor would also rise almost immediately to achieve a maximum gradient of 6%. The access corridor would then continue over the rail lines by means of a bridge before ramping down at maximum gradient of 6% to reach existing ground levels.

Again, in order to maximise the land available for development within the Five Acre site, the western side of the access corridor would require retention by retaining walls in order to avoid encroachment into the parking areas.

The roundabout junction solution in the Network Rail parcel of land provides an ideal change in direction for this access corridor and provides an ideal junction location to link with an access corridor from Water End.

The vertical profile as presented on Drawing CTDAOB003-008 at Appendix C illustrates the elevation of the access corridor (shown in a continuous red line) above existing ground levels (shown in a dashed green line) and also gives details of the vertical design features (gradients, vertical curve radii and lengths of gradients and curves).

This access corridor would not require the demolition of any buildings within the Five Acre site, but would ultimately require demolition work within the York Central site.

As illustrated on the plan drawing, a reasonable level of landscaping could be provided to the embankments which would assist in screening the access corridor from any future development in the Five Acre site, but not to Holgate Park Drive.

5.6 Bridge Design Options

At Holgate Park there are a number of options for the different Rail Land Options outlined above.

Access corridor B1, Land Use Scenario 1 to 5

For access B1, Rail Land Options 1-5 two concepts are proposed.

Bridge Solution A is to provide a tied arch with ladder deck with a span of approximately 80m. The design option is presented in Drawing No. CTDAOB-003-017 in Appendix C. A tied arch would be a statement bridge which gives a sense of identity to the York Central development. The shape of the arch mirrors the arch barrels used in the York Railway station roof. It is anticipated that for a tied arch, the maximum rise at the centre of the arch would be over 16m. It is expected that this would be visible from York Minster and that further consultation would be required to determine if this would be acceptable. The proposed bridge has a deck depth to finished road levels of around 1.6m, which is less than the 2m depth initially assumed in this study. Subject to a more detailed assessment of levels (See Table 5.4 on risks) the implications of this would be to reduce the link road elevation and embankment/retaining structure, land take and costs associated with this option at the detailed design stage.

Bridge Solution B shown on CTDAOB-003-018. It is a two span asymmetric bridge to cross multiple tracks comprising tracks to the Thrall works, FAL tracks and six sidings with spans of approximately 26m and 51m. The larger span is outside the range for pre-stressed concrete beams. As the maximum pre-stressed concrete beam length that can be manufactured and transported is approximately 37m a composite steel deck is proposed.

Due to the longer span, the proposed deck construction would comprise of 5 No. 2.1m deep (approx.) steel box beams. These act compositely with a 200mm thick insitu concrete deck slab. The box beams would be continuously connected to steel plate girders in the shorter span. Steel plate girders would be braced in pairs and would be of an equal depth to the box beams. Externally, both bridge spans would look similar in appearance and form. The insitu concrete deck slab would be cast onto a permanent formwork soffit between main beams. However, as this span is greater than the initial assumption of 44m span, the road level would need to be increased in order to achieve the clearance over the railway lines, the proposed bridge has a deck depth to finished road levels of around 2.6m, which is greater that the 2m depth initially assumed in the study to generate the vertical highway alignment. Subject to a more detailed assessment of levels (See Table 5.4 on risks) the implications of this maybe that the link road gradient marginally exceeds the CYC design guidance levels, as well as increasing costs and landtake requirements for embankment and retainment in this option. At the detailed design stage further design iterations and cost/benefit analysis would need to be undertaken to evaluate the relative merits of a thinner deck design.

The box girders and plate girders would be fabricated from weathering steel. Weathering steel develops a patina of rust that protects the main body of the steel. Weathering steel does not need to be painted hence it is a preferred construction material over rail as maintenance liabilities are minimised. In addition, weathering steel is the preferred option on box girders as there is no requirement to paint the inside of the box which would normally require a surface treatment to prevent corrosion.

As an alternative to this solution, the crossing could comprise two simply supported spans with a large shared abutment constructed on the lens of land between the Thrall access and the FAL.

Parapets would comprise of metallic post and rail, high containment units attached to reinforced concrete deck upstand on each elevation. Parapets would be 1500mm high and would include a solid metal infill plates on the traffic face.

Abutments and piers would comprise reinforced concrete cantilever units. At their base, the abutments would merge into a reinforced concrete pile cap. Piles are expected to be continuous bored cast in situ reinforced concrete. This type of pile provides a seal to the surrounding soils and restricts the amount of groundwater flow.

Services zones can be created in the spaces between the girders.

Some of the benefits of this type of construction at this location are:

- Bored cast insitu piles reduce the risks of ground heave and vibration on the adjacent railway during their installation.
- Forming the girders out of weathering steel reduces maintenance liability as compared with structural steel with a protective coating.
- Deck construction can continue outside of possessions, during daytime working, once the girders and permanent formwork panels are in place.
- Metallic post and rail parapets can be delivered to site and erected without the need for cranes and therefore their use reduces the number of planned possessions/ isolations required.

Access corridor B1, Rail Land Option 6

For access B1 Rail Land Option 6 there are two bridge solutions.

Bridge Solution A is for a box girder bridge in a similar form to as the proposal for Rail Land Options 1 to 5, the scheme design is presented in Drawing No. CTDAOB/003/019 in Appendix D. The clear span is approximately 55m. This would result in a construction depth of approximately 2.8m including surfacing, which would be greater than the 2m depth initially assumed in the study. Although this would be subject to a more detailed assessment of levels the potential implication of this would be to increase the link road gradient beyond CYC design guidance levels, as well as increasing the costs and landtake requirements for the embankment and retainment in this option at the detailed design stage, unless an alternative bridge design solution with a thinner deck was utilised. The scheme design is presented in Drawing No. CTDAOB-003-019 in Appendix C.

Bridge Solution B shown in Drawing No. CTDAOB-003-020 in Appendix C is for two individual bridges, similar in construction to those proposed for Chancery Rise. One bridge would span approximately 19m over the Thrall works sidings and the subsequent bridge would span approximately 22m over the FAL tracks. The proposed bridges have a deck depth to finished road level of around 1.67m, which is less than the 2 m depth initially assumed in the study. The potential implications of this would be to reduce the link road elevation and embankment/retainment landtake and costs associated with this option at the detailed design stage.

The proposed deck construction of both bridges would comprise of 16 No. precast prestressed concrete beams. 14 No. 'M5' beams and 2 No. 'UM5' beams at the deck edges. Beams would be spaced at 1000mm centres. An insitu reinforced concrete deck slab of circa. 200mm thick would be cast over the beams on to permanent formwork soffit panels. The insitu deck concrete would form an integral structure with the abutments. It is anticipated that the shorter span bridge would be constructed utilising the same precast beam types as the adjacent longer span. This would result in an overdesigned bridge deck, but would allow the external elevations to have the same structural depth and appearance.

Parapets would comprise precast concrete high containment units attached to the main body of the deck slab. Parapets would be supplied to a minimum height of 1500mm above the adjoining footway surfacing level.

Again the outer face of the parapet units could have a lightly ribbed or exposed aggregate finish to detract from the bland nature.

Abutments would comprise of reinforced concrete stem cantilever units structurally connected to the deck to form an integral bridge. At their base, the abutments would merge into a reinforced concrete pile cap. Piles are expected to be continuous bored cast in situ reinforced concrete.

Wing walls located between the two, closely spaced, internal abutments could be constructed in the same manner as the abutments or could utilise a reinforced earth solution to maintain the embankment fill.

Services corridors can be created within the voids between the concrete beams within the deck.

Some of the benefits of this type of construction at this location are:

- Bored cast insitu piles reduce the risks of ground heave and vibration on the adjacent railway during their installation.
- Forming the abutments and deck slab as an integral bridge will reduce any future maintenance issues with bridge bearings and reduce the need for access onto the rail infrastructure beneath the structure.
- The use of precast concrete beams will minimise future maintenance requirements for the deck slab soffit. Being manufactured in a controlled factory environment they are very durable elements.
- The use of precast bridge beam units will reduce the night time possessions required to construct the bridge deck.

- Deck construction can continue outside of possessions, during daytime working, once the precast concrete bridge beams and permanent formwork panels are in place.

Access corridor B2, Rail Land Option 1 to 5

For this proposal, the clear bridge span is approximately 110m. In order to bridge the tracks at this location a tied arch bridge is proposed which is similar to bridge solution A proposed on access corridor B1, although the maximum rise of the arch would be in the order of 20m. As with that option, consultation will be required to determine if it is acceptable to alter the views of the York skyline from the minster. The bridge deck to finished road level associated with this option would be in the region of 2.0m.

Access corridor B2, Rail Land Option 6

For this proposal, the clear bridge span is approximately 60m. A box girder bridge in a similar form as the Bridge Option A for access corridor B1 Rail Land Option 6 is suggested. The scheme design is presented in Drawing No. CTDAOB/003/021 in Appendix C. The design would result in a construction depth of approximately 2.8m to finished highway level which is greater than the 2m allowance made in the initial assumption. The implications of this would be to increase the link road gradient beyond CYC design guidance levels as well as increasing the costs and landtake requirements for embankment and retainment in this option as the detailed design stage, unless an alternative bridge design solution with a thinner deck was utilised.

5.7 Preliminary Scheme Costs

The preliminary scheme costs for the works are presented in Tables 5.2 and 5.3. Optimism bias of 44% has been applied to the scheme costs based on guidance issued by the Department for Transport.

Table 5.2 Estimated Scheme Costs for Access corridor B1 (2011 Prices)

Description	Cost (£)	Cost (£)	Cost (£)	Cost (£)
Land Rail Use Option	1 to 5	1 to 5	6	6
Option	A	B	A	B
Junction Improvement	214,230	428,460	241,230	428,460
Access corridor	2,959,572	3,010,311	2,893,511	2,939,513
Bridge Designs	6,403,079	6,403,079	4,428,460	4,428,460
Archaeology	125,235	125,235	125,235	125,235
Sub total (including General preliminaries, design and supervision costs and contingencies)	9,702,116	9,967,085	7,661,436	7,921,669
Optimism Bias (@ 44%)	4,268,931	4,385,517	3,371,032	3,485,534
Total	13,971,047	14,352,602	11,032,468	11,407,203

Table 5.3 Estimated Scheme Costs for Access corridor B2 (2011 Prices)

Description	Cost (£)	Cost (£)	Cost (£)	Cost (£)
Land Rail Use Option	1 to 5	1 to 5	6	6
Option	A	B	A	B
Junction Improvement	214,230	428,460	214,230	428,460
Access corridor	2,849,629	2,941,996	2,803,717	2,833,753
Bridge Designs	8,698,760	8,698,760	4,621,810	4,621,810
Archaeology	125,235	125,235	125,235	125,235
Sub total (including General preliminaries, design and supervision costs and contingencies)	11,887,854	12,194,452	7,764,992	8,009,258
Optimism Bias (@ 44%)	5,230,656	5,365,559	3,416,596	3,524,074
Total	17,118,510	17,560,011	11,181,588	11,533,332

5.8 Design and Project Risks

The existing Holgate Beck Culvert (shown in Figure 5.3) could be affected by the works. Further consultation is necessary with the Environment Agency to understand the construction depth of the culvert and the likelihood of any settlement as a result of the additional load.

The viability of any of the routes for access corridor B relies on the ability to improve either the existing T-junction at the eastern end of Holgate Park Drive or the existing roundabout in the middle portion of Holgate Park Drive. If the land required for such improvements is not CYC adopted highway land, third parties will have to be approached to seek consent for such upgrades.

It is also understood that Network Rail has an interest in the Five Acre Site in order to extend sidings over to the Thrall Works sidings. This would seriously compromise the viability of any access corridor as there is insufficient length on the approach to gain height in order to cross the new sidings with the required headroom.

The concept is based on the rail levels of the adjacent siding tracks. No level information is currently available for the FAL. However, from a site inspection it would appear that the risk of the rails being significantly higher than assumed is minimal. To accommodate some variation to the actual FAL levels, additional headroom of 200mm has been allowed.

The viability of this access point depends on the form of the bridge adopted. A major risk for the longer spans is that the construction depth increases. The consequence of this is that the vertical alignment gradients will need to increase in order to provide the minimum rail headroom clearance, with implications on accessibility as well as cost and landtake requirements. An alternative bridge in the form of a tied arch is suggested which would satisfy both the maximum gradients and the headroom requirements however its impact on the York skyline would need careful consideration. On further site surveys and development of the design, the initial concept proposal can be value engineered to reduce road level whilst maintaining the required headroom. This could reduce the approach gradients and extent of earthworks.

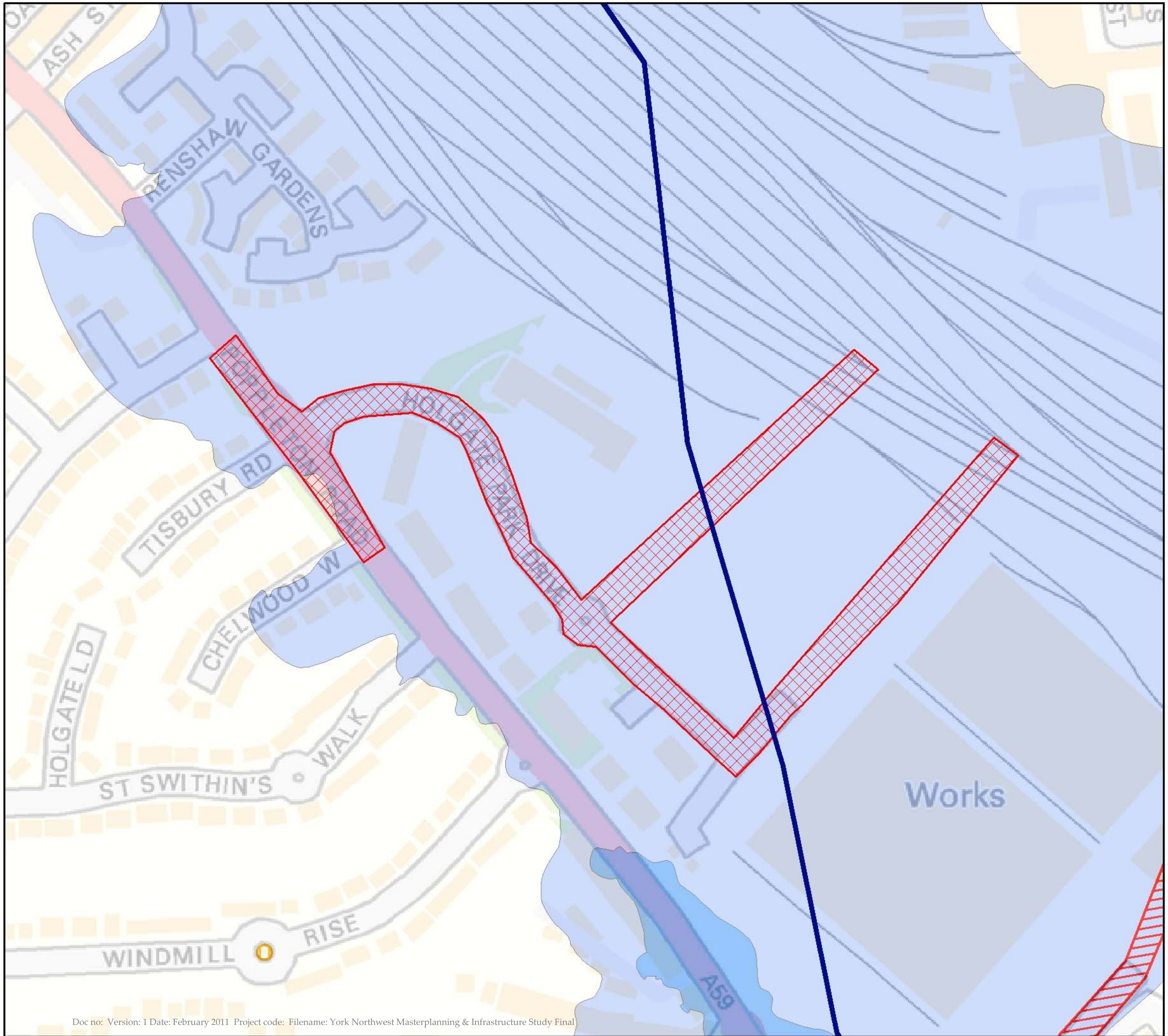
The concept is based on the current position of the rail tracks. If future slewing of the tracks or additional tracks are added, then the proposal may no longer be suitable.

No consideration has been made to the possible effects the structure may have on Network Rail's signalling infrastructure. If sighting distances are reduced/ impaired, re-signalling works may need to be undertaken.

The piled foundation proposals are only indicative at present, a site investigation local to the final bridge's location would provide accurate assessment of the ground conditions. From previous site investigation reports undertaken in and around the site it is understood that there are peat and highly compressible soil layers in the vicinity. A piled solution therefore seems likely at this point.

An investigation into the presence of any utility service providers buried infrastructure has not been made at this stage. Service diversions may be required following this activity.

A summary of the principal project risks is provided in Table 5.4 and provides a useful table for further scheme development.



Legend

- Existing Culvert
- Access Option B
- Tree preservation order
- SINC area
- Scheduled Ancient Monument
- Listed Buildings
- Conservation Areas
- Areas Of Archaeological Importance

SFRA Flood Zones

zone

- 1in1000
- 1in100 Nodefences
- 1in100 Withdefences 1/100
- 1in100 Withdefences 1/50
- 1in25 Developed Areas
- 1in25 Nodefences

Halcrow Group Ltd
Arndale House
Otley Road
Headingley
Leeds
LS6 2UL

York Central Bridge Engineering Study Access Corridor B Site Constraints

Figure 5.3

Drawn by: Pam Murray

Date Drawn: 15/03/2011

Doc no: Version: 1 Date: February 2011 Project code: Filename: York Northwest Masterplanning & Infrastructure Study Final

Table 5.4 Summary of principal design and project risks (Access corridor B)

Risk	Likelihood (Scale 1 to 5, where 1 is low probability 5 is high probability)	Impact (Scale 1 to 5 where 5 is high impact and 1 low impact)	Score	Mitigation
Network Rail pursues the development of the Thrall works and the implementation of additional rail service lines	4	5	20	Continued dialogue with Network Rail.
Scheme does not have sufficient clearance of the FAL and associated rail sidings	4	4	16	Either adopt bridge form with a thinner deck construction but with significant parts of the superstructure visible above carriageway level or accept departure from standard to increase the vertical gradients on the approaches.
Settlement risk for Holgate culvert due to additional load of embankment design	4	4	16	Instigate early consultation with the Environment Agency. Undertake further detailed design and establish depth of the culvert at the locations affected by the embankments.
Proposed foundation design provide insufficient load bearing capability	3	4	12	Instigate geotechnical investigations in the vicinity of the bridge and embankment
Scheme affects utility apparatus	5	2	10	Instigate requests from utilities to understand what apparatus maybe affected by the works.
Scheme affects Network Rail signalling equipment	3	3	9	Instigate early consultation with Network Rail to establish signalling requirements for the FAL and Engineer's triangle
Negotiations fail with stakeholders/landowners on the junction improvement options on Holgate Park Drive	3	3	9	Look to value engineer scheme and reduce impact on neighbouring land owners. Instigate early consultation with adjacent land owners.
FAL and associated rail sidings rail levels unknown	2	3	6	Undertake comprehensive levels survey on the FAL and land occupied by the link road prior to detailed design.
Areas of archaeological interest	2	2	4	Early consultation with archaeological stakeholders

5.9 Buildability Assessment

The construction of any of the access corridors does not pose any significant or unusual engineering problems. The majority of the length of the corridors would be constructed on embankments or retained by structures.

Works to connect the access corridors to the existing junctions within Holgate Park Drive would not present any more difficulty than usual in traffic management terms for works of a junction improvement scheme.

Works are close to existing boundaries of development land in some locations, but again are not unusual for highway works.

As this access corridor is not an existing access to any property or other through routes, construction activity would not cause any traffic management issues.

The construction of the proposed bridges included in the Access B1 and B2 corridors, do not pose any significant or unusual engineering problems. However, the usual difficulties and restrictions of working adjacent to overhead electrified railway lines, in close proximity to urban areas and adjacent to existing business and industrial units will exist.

Access to the bridge site would be gained on the southern side utilising the existing access to Holgate Park. Access to the northern side would be gained using the existing access points from Leeman Road.

When considering the options for Access B1, which utilise a central pier or abutments constructed within the land available between the FAL and Thrall works sidings, an assumption has been has been made that access will be available via the Thrall works following negotiations.

Works adjacent to live railways and the overhead electrified lines are inevitable with this or any other form of structure provided at this location. The establishment of site boundaries, the piling operation, excavation for the pile caps, the erection of temporary works to form the abutments and the deck construction will all require the contractor to work closely with Network Rail and Thrall works. All works will require Network Rail's prior approval, the use of pre-booked possessions and isolations of the Over Head Line Equipment.

The use of precast concrete beams or fabricated steel sections with permanent formwork decking for the bridge decks will reduce the possessions and isolations required for its construction.

The construction of the highway in York Central does not present any major issues.

5.10 Summary

This chapter has examined the engineering feasibility of constructing a new access into York Central via Holgate Park Drive.

The assessment concludes that the existing Holgate Park Drive/A59 Poppleton Road junction has sufficient highway capacity to absorb the increase in traffic levels.

There are two potential options for the access corridor either side of the Five Acre site. The differing Rail Land Option discussed in Section 1.3 of this report, present further options for crossing the railway line sidings and FAL from the Five Acre Site.

A number of options have been developed for the highway and bridge designs to facilitate access for each of the Rail Land Options.

The estimated cost of the works ranges from £11.2 million to £17.6 million in 2011 prices.

The preliminary investigation and design work does not indicate there to be any major engineering issues associated with the access corridor. There are no major construction issues associated with the scheme options.

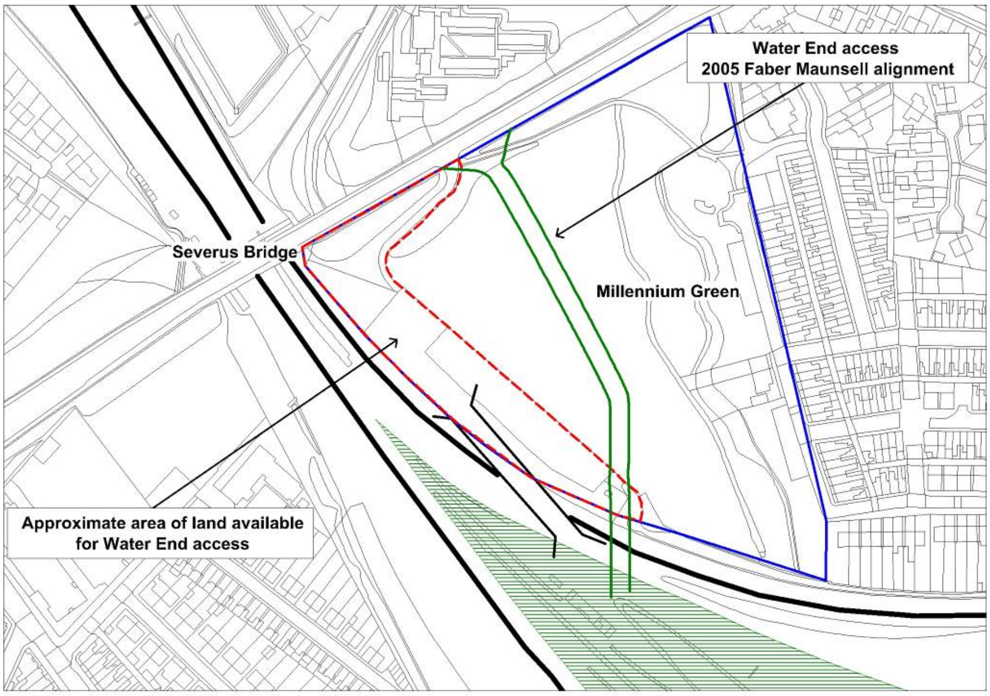
The main project risks are the choice of form of bridge which depend on the access location in conjunction with consideration of rail land option and Network Rail's intentions for the Five Acre site. If they pursue the development of the Thrall site this would seriously compromise the viability of the access options proposed in this chapter.

6 Water End (Access corridor C)

6.1 Introduction

The possibility of an access at Water End was investigated by Faber Maunsell in 2005 as part of an earlier York Central traffic study. This work proposed a highway and bridge design solution which severed Millennium Green. It is anticipated this is likely to have a significant impact on users of this important green facility. The focus of this study is to explore the implications of various rail retention scenario's (as set out in table 1.2) on Water End access, whilst accommodating the junction improvement, highway and bridge design solutions so that they maximise open space retention and retain the integrity of Millennium Green. The area identified for the access is shown in Figure 6.1. Figure 6.1 also shows the previous Water End access alignment.

Figure 6.1 Area of land available for Water End access and previous highway alignments



The remainder of this report provides an update to the earlier work. Moreover this chapter of the report examines bridge and highway alignments for the Rail Land Options 1 to 6.

6.2 Existing Situation

Water End is an important orbital highway connecting the A19 Shipton Road to the A59 Poppleton Road and alongside the inner ring road and the outer ring road provides the only means of crossing the River Ouse on the western half of the city. The importance of the route is demonstrated by traffic flows which are greater than some principal routes in the City including the A19 Fulford Road and the A1079 Hull Road. With heavy traffic flows combined with congestion at peak times the engineering solution for the junction improvement is substantial.

Severus Bridge which is shown on Figure 6.1 provides a crossing over the East Coast Main Line (ECML) and Freight Avoiding Line (FAL). On the northern side of Severus Bridge is a pipe bridge which would be very costly to move as part of any engineering works associated any junction improvement.

Plate 6.1 Pipe Bridge on the northern side of Severus Bridge

At the south western end of Water End at its junction with the A59 Poppleton Road is Poppleton Road Primary School. Further to the north east Water End is elevated with open landscaped areas on either side of the highway. Millennium Green is on the south side of Water End with an area of land owned by Network Rail between the ECML and Millennium Green available for the access corridor (Plate 6.2).

Plate 6.2 View from Severus Bridge showing allotments, the ECML and area of land available for the access corridor

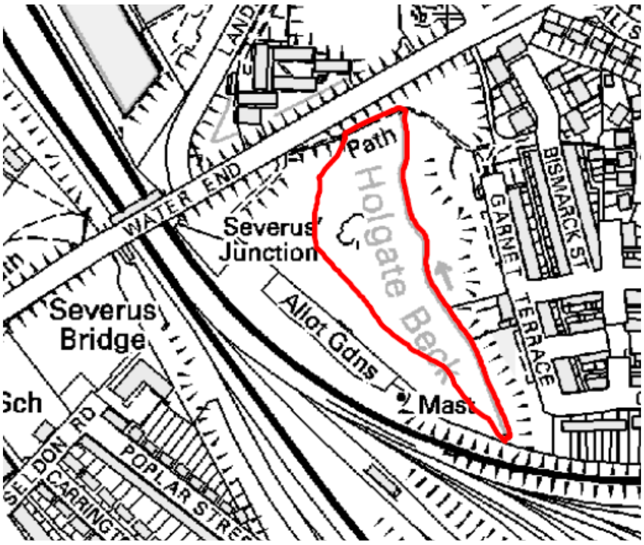
6.3 Junction Improvement Options

The requirement to minimise the impact on Millennium Green results in a constraint to keep the junction to the west of the site. In this position, the interaction of the junction needs to be considered with Severus Bridge. The main issues are the restricted width of the bridge, its proximity to the area of land identified for the access corridor and the requirement for dedicated traffic lanes into and out of the development site to the meet the traffic requirements. The previous Faber Maunsell design did not have this constraint and as such the development of a suitable infrastructure solution was substantially easier to achieve.

Other constraints in the immediate area include:

- the elevation of Water End which at this location is approximately six metres above the surrounding ground level from where the access corridor will join from
- the gradient on Water End and the effects this may have on stopping distances and visibility splays
- environmental constraints associated with Millennium Green and Holgate Beck including a Site Important to Nature Conservation (SINC) to the east of the access corridor restricting available land as shown in Figure 6.2
- the pipebridge shown in Plate 6.1 on the northern side of Severus Bridge
- third party land on the northern side of Water End

Figure 6.2 Area of land designated a SINC



Options have been developed with a view to minimising the likely bridge requirement and the impact on the SINC, whilst being designed in accordance with relevant guidance in the form of Manual for Streets, Design Manual for Roads and Bridges, Traffic Sign Regulations and General Directions and Local Transport Notes. A mixture of these documents have been utilised to provide as compact a design as possible for each option developed.

Additional requirements at this location are to provide a high quality cycle and pedestrian environment to link in with the British Sugar site accessed via the Landing Lane route, and connections to the proposed access corridor. Notwithstanding this there is an existing off and on street cycle provision along Water End that needs to be maintained within the options proposed.

Additionally, all options include for the access corridors to be elevated on a viaduct structure, commencing at Water End and continuing to the extents shown for each junction option as described below. The viaduct costs are included in Table 6.1 for clarity.

Four options have been developed at this location which are:

- Option 1 – Signalised T-junction, with fully replaced bridge structure
- Option 2 – Signalised T-junction, with additional bridge adjacent to existing bridge
- Option 3 – Signalised double T-junction, with new pedestrian/cycle bridge structure
- Option 4 – Compact roundabout

Option 1 – Signalised T-junction, with fully replaced bridge structure

Option 1 is shown on drawing CTDAOB-004-001 in Appendix D. The design includes for the following features:

- pedestrian and cycle facilities across all arms
- on street cycle lanes for all approaches, linking into existing facilities
- the provision of dedicated left and right turn lanes from the proposed access corridor
- a new 20m wide bridge crossing ECML and FAL to accommodate vehicular and non-motorised users.
- new 3m wide landscaping corridor along access road, and on part of the eastern section of Water End, adjacent to the junction improvements

Option 2 – Signalised T-junction, with additional bridge adjacent to existing bridge

Option 2 is shown on drawing CTDAOB-004-002 in Appendix D. The design includes for the following features:

- pedestrian and cycle facilities across all arms
- on street cycle lanes for all approaches linking into existing facilities with the exception of Water End east approach
- a new 9.5m wide bridge structure to provide left turn from the development, plus pedestrian and cycle facilities
- shared use pedestrian and cycle path adjacent to Water End East, linking into Toucan crossing facilities and dedicated facilities on the new bridge structure
- the provision of dedicated left and right turn lanes from the proposed access corridor
- new 3m wide landscaping corridor along access road and on part of the eastern section of Water End adjacent to the junction improvements

Option 3 – Signalised double T-junction, with new pedestrian/cycle bridge structure

Option 3 is shown on drawing CTDAOB-004-003 in Appendix D. The design includes for the following features:

- pedestrian and cycle facilities across all arms

- on street cycle lanes for some approaches, linking into existing facilities where formal provision is not provided. Lane widths have been increased in line with current design guidance (Manual for Streets 1&2)
- the provision of dedicated left and right turn lanes from the proposed access corridor
- a new 4m wide pedestrian and cycle bridge structure
- new 3m wide landscaping corridor along access road and on part of the eastern section of Water End adjacent to the junction improvements
- landscaped areas within the junction footprint to improve the environment and visual amenity

Option 4 – Compact roundabout

Option 4 is shown on drawing CTDAOB-004/004 in Appendix D. The design includes for the following features:

- on street pedestrian and cycle links within the junction layout (Design proposals similar to layout at Heworth Green, York)
- pedestrian crossing provision across two arms of the junction with a signalised crossing point is provided on Water End to the west of the junction
- a compact roundabout providing a cycle bypass lane for movements from Water End west to east
- no new bridge is required
- new 3m wide landscaping corridor along access road and on part of the eastern section of Water End adjacent to the junction improvements

Option Assessment

Table 6.1 provides an assessment of all four options and assesses them against key criteria.

Table 6.1 Assessment of Water End Junction Designs

Option	Estimated Cost (£M) (including cost of viaduct, preliminaries and Optimism Bias)	Estimated cost to allow for elevated viaduct construction	Cycle Routes	Land Requirements	Traffic Capacity[1]	Buildability	Traffic Management
Option 1 – Signalised T-junction, with fully replaced bridge structure	20,682,901	11,047,848	Cycle routes on Water End and on the access corridor into York Central. Integrates with potential cycle route via Landing Lane.	Majority of works within identified land parcel although widening works on the southern side of Water End may impact on School Playing Fields	Ability to accommodate predicted traffic levels	Complex engineering solution involving works over the ECML	Significant disruption issues during construction
Option 2 – Signalised T-junction, with additional bridge adjacent to existing bridge	20,752,440	11,129,685	Cycle routes on Water End although eastbound advisory only. Cycle routes on the access corridor into York Central. Integrates with potential cycle route via Landing Lane.	Majority of works within identified land parcel although widening works on the southern side of Water End would impact on School Playing Fields	Ability to accommodate predicted traffic levels although reduced capacity in comparison to Option 1	Complex engineering solution involving works over the ECML although not as complex as Option 1.	Significant disruption issues during construction although building adjacent structure provides flexibility for traffic management arrangements
Option 3 - Signalised double T-junction, with new pedestrian/cycle bridge structure	26,307,289	14,484,959	Cycle routes in both directions on Water End although eastbound advisory only. Cycle routes on the access corridor into York Central. Reduced integration with potential cycle route via Landing Lane.	Majority of works within identified land parcel although more encroachment into Millennium Green Area	Traffic congestion issue anticipated during PM Peak	Complex engineering solution involving works over the ECML although provision of new pedestrian/cycle bridge simplifies works.	Significant disruption issues during construction although building adjacent structure for pedestrians and cyclist provides flexibility
Option 4 - Compact roundabout	16,096,357	9,247,460	Cycle routes on Water End and on the access corridor into York Central. Integrates with potential cycle route via Landing Lane.	Works within identified land parcel	Ability to accommodate predicted traffic levels with spare capacity	Complex engineering works although crucially no works to Severus Bridge.	Disruption to be expected although construction window will be less as no bridge engineering works

1 Appendix E Provides a summary of the traffic capacity assessments for each option

Based on estimated cost, integration with cycle routes, land requirements, traffic capacity, buildability and traffic management arrangements the assessment shows Option 4 to be the preferential option.

6.4 Access corridor Options

The access corridor into the developable areas of Network Rail land would form a junction with Water End as described above, before continuing across the ECML into the northern end of the site.

The differing Rail Land Option discussed in Section 1.3 of this report, present alternative options for crossing ECML, Transfer Line, Warehouse Line and North Arrival. The various Rail Land Options present different lengths of crossing and these are considered for each crossing option below.

In total, four access corridor Options have been considered, with two variations for the Land Rail Use Option 4. Each of the corridors extends to a point within the site from which local development roads could then be constructed.

A summary of the options available is summarised below:

- Access corridor C, Rail Land Options 1 to 3
- Access corridor C, Rail Land Option 4, Option A
- Access corridor C, Rail Land Option 4, Option B
- Access corridor C, Rail Land Option 5
- Access corridor C, Rail Land Option 6

Access corridor C, Rail Land Options 1 to 3

This option presented as Drawing CTDAOB-004-005 in Appendix D provides a corridor of approximately 715m and follows the eastern side of the existing allotments before bridging over the ECML and Transfer Line at approximately 45 degrees at the northern side of the site. The corridor curves to follow the line of the eastern of the two separate parcels of land continuing south-eastwards before crossing the Warehouse Line at a very high skew. As a consequence of the shape of this land parcel the bridge crossing would need to be approximately 250m before eventually reaching the main development site.

The corridor would commence at the existing level of Water End and continue in an elevated aspect in order to cross the ECML to achieve the required 5.8m clearance over the rail lines. This would be achieved by a combination of embankment at the Water End section and then a pier arrangement continuing through to the bridge crossing. The corridor remains elevated in order to cross the Warehouse Line at the required 5.8m clearance and could be achieved by either a pier arrangement or retaining wall supporting the highway. Once the Warehouse Line is negotiated, the access corridor begins to lower immediately to achieve a maximum gradient of 6% and to reach existing levels as quickly as possible.

The vertical profile as presented on Drawing CTDAOB-003-006 in Appendix D illustrates the elevation of the access corridor (shown in a continuous red line) above existing ground levels (shown in a dashed green line) and also gives details of the vertical design features (gradients, vertical curve radii and lengths of gradients and curves).

This access corridor would not require the demolition of any buildings within the site, but would ultimately require demolition works within the Network Rail Site.

As illustrated on the plan drawing, a reasonable level of landscaping could be provided to both sides of the access corridor in the vicinity of Millennium Green where land availability permits to assist in screening the corridor from the residential area to the east.

Access corridor C, Rail Land Option 4A

This option presented as Drawing CTDAOB-004-007 in Appendix D provides a corridor of approximately 550m and follows the eastern side of the existing allotments before bridging over the ECML and Transfer Line at approximately 45 degrees at the northern side of the site. The corridor curves to follow the line of the eastern of the two separate parcels of land continuing south-eastwards before crossing the Warehouse Line at a skewed angle to bridge into the main development site. In Rail Land Option 4, the available parcel of land begins much further to the north and hence results in reduced bridge spans and an overall shorter access corridor length.

The corridor would commence at the existing level of Water End and continue in an elevated aspect in order to cross the ECML to achieve the required 5.8m clearance over the rail lines. This would be achieved by a combination of embankment at the Water End section and then a pier arrangement continuing through to the bridge crossing. The corridor remains elevated in order to cross the Warehouse Line at the required 5.8m clearance and could be achieved by either a pier arrangement or retaining wall supporting the highway. Once the Warehouse Line is negotiated, the access corridor begins to lower immediately to achieve a maximum gradient of 6% and to reach existing levels as quickly as possible.

The vertical profile as presented on Drawing CTDAOB-003-008 in Appendix D illustrates the elevation of the access corridor (shown in a continuous red line) above existing ground levels (shown in a dashed green line) and also gives details of the vertical design features (gradients, vertical curve radii and lengths of gradients and curves).

This access corridor would not require the demolition of any buildings within the site, but would ultimately require demolition works within the Network Rail Site.

As illustrated on the plan drawing, a reasonable level of landscaping could be provided to both sides of the access corridor in the vicinity of Millennium Green where land availability permits, to assist in screening the corridor from the residential area to the east.

Access corridor C, Rail Land Option 4B

This option presented as Drawing CTDAOB-004-009 in Appendix D provides a corridor of approximately 485m and follows the eastern side of the existing allotments before bridging over the ECML and Transfer Line at approximately 30 degrees at the northern side of the site, much closer to the residential area to the east but resulting in the requirement for only one bridge. The corridor continues in a straight line from Water End and over the ECML and Transfer line. In this configuration there is no need to cross the Warehouse Line, which results in an extended bridge span but an overall shorter access corridor length.

The corridor would commence at the existing level of Water End and continue in an elevated aspect in order to cross the ECML to achieve the required 5.8m clearance over the rail lines. This would be achieved by a combination of embankment at the Water End section and then a pier arrangement continuing through to the bridge crossing. Once the ECML and Transfer Line are negotiated, the access corridor begins to lower immediately to achieve a maximum gradient of 6% and to reach existing levels as quickly as possible.

The vertical profile as presented on Drawing CTDAOB-003-010 in Appendix D illustrates the elevation of the access corridor (shown in a continuous red line) above existing ground levels (shown in a dashed green line) and also gives details of the vertical design features (gradients, vertical curve radii and lengths of gradients and curves).

This access corridor would not require the demolition of any buildings within the site, but would ultimately require demolition of any within the Network Rail Site.

As illustrated on the plan drawing, the opportunity for landscape screening within the allotments area is vastly reduce owing to the ECML crossing location. Landscaping could be provided in Millennium Green where land availability permits, to assist in screening the corridor from the residential area to the east, but this may be considered disruptive to the open nature of this land.

Access corridor C, Rail Land Option 5

This option presented as Drawing CTDAOB-004-011 in Appendix D provides a corridor of approximately 385m and follows the eastern side of the existing allotments before curving to bridge the ECML and Transfer Line at about 45 degrees. The corridor then curves to continue south-eastwards into the main development site. This configuration results in a much reduced bridge span and shorter overall access corridor.

The corridor would commence at the existing level of Water End and continue in an elevated aspect in order to cross the ECML to achieve the required 5.8m clearance over the rail lines. This would be achieved by a combination of embankment at the Water End section and then a pier arrangement continuing through to the bridge crossing. Once the ECML and Transfer Line are negotiated, the access corridor begins to lower immediately to achieve a maximum gradient of 6% and to reach existing levels as quickly as possible.

The vertical profile as presented on Drawing CTDAOB-003-012 in Appendix D illustrates the elevation of the access corridor (shown in a continuous red line) above existing ground levels (shown in a dashed green line) and also gives details of the vertical design features (gradients, vertical curve radii and lengths of gradients and curves).

This access corridor would not require the demolition of any buildings within the site, but would ultimately require demolition works within the Network Rail Site.

As illustrated on the plan drawing, the area for landscape screening within the allotments area is increased owing to the ECML crossing location. Opportunity also exists in this arrangement for extensive landscaping at the location where the access corridor returns to existing levels in the development plot.

Access corridor C, Rail Land Option 6

This option presented as Drawing CTDAOB-004-013 in Appendix D provides a corridor of approximately 345m and follows the eastern side of the existing allotments before curving to bridge the ECML and Transfer Line at about 60 degrees. The corridor then curves to continue south-eastwards into the main development site. This configuration results in a much reduced bridge span and shorter overall access corridor.

The corridor would commence at the existing level of Water End and continue in an elevated aspect in order to cross the ECML to achieve the required 5.8m clearance over the rail lines. This would be achieved by a combination of embankment at the Water End section and then a pier arrangement continuing through to the bridge crossing. Once the ECML and Transfer Line are negotiated, the access corridor begins to lower immediately to achieve a maximum gradient of 6% and to reach existing levels as quickly as possible.

The vertical profile as presented on Drawing CTDAOB-003-014 in Appendix D illustrates the elevation of the access corridor (shown in a continuous red line) above existing ground levels (shown in a dashed green line) and also gives details of the vertical design features (gradients, vertical curve radii and lengths of gradients and curves).

This access corridor would not require the demolition of any buildings within the site, but would ultimately require demolition works within the Network Rail Site.

As illustrated on the plan drawing, the area for landscape screening within the allotments area is increased owing to the ECML crossing location. Opportunity also exists in this arrangement for extensive landscaping at the location where the access corridor returns to existing levels in the development plot.

Any highway crossing of the ECML in this area is likely to be visually intrusive and mitigation measures should be considered. The construction of the access corridor on embankment has been considered but this is likely to very land consuming encroaching into the Millennium Green area. This would however present landscaping opportunities to screen the corridor. The construction of this corridor with retaining structures would minimise land take but present a solid façade to the corridor. This could again be screened with suitable landscaping. The final option that has been considered is to construct the access corridor on a viaduct type structure, effectively a bridge supported on multiple piers. This would retain an open aspect, provide areas beneath the structure could be developed and could also be screened with suitable landscaping.

6.5 Bridge Design Options

For all approaches into the site prior to reaching any of the railway crossing points, the route will be supported on a viaduct structure across the Network Rail land. This is in order to minimise the reduction in flood alleviation capability of Millennium Green and to maximise the amenity value of Millennium Green. The approaches will comprise 1 span of approximately 20m length followed by 5 spans of approximately 30m length. It is anticipated that the form of construction will be of prestressed concrete beams similar to the arrangement proposed at Access Corridor A, Chancery Rise. Thereafter a number of alternative solutions are proposed which are dependent on the rail land option.

Access corridor C, Rail Land Options 1 to 3

A bridge span of approximately 50m is required to cross the ECML. At this location, steel box girders are proposed similar to the detail shown on drawing CTDAOB-003-018 at Access B1, Bridge solution B1. It is then anticipated that the road would be maintained at a high level by a reinforced earth retaining wall before continuing as a single span of at least 250m over the sidings. It is likely that the form of this bridge would need to be a cable stayed structure. The Flintshire Bridge close to Connah's Quay has a main span of 200m and the inverted Y-tower extends 120m above the river. It is anticipated that a structure of similar proportions would be required in this location. The construction cost in 1998 was £30 million for the 950m dual carriageway bridge including 200m main span. In 1998 prices, it is expected that the cost of the cable stayed element would be approximately £10.4 million and in 2011 prices would be approximately £17.3 million. On the basis that the York Central bridge will be single carriageway, the cost of this element is expected to be in the region of £13 million.

Plate 6.3 The Flinsthire Bridge

Access corridor C, Rail Land Options 3

In order to access the individual parcel of land immediately south of Leeman Road a bridge span of approximately 55m is required to cross the ECML. For this option, steel box girders in weathering steel are proposed, similar to the proposal shown on drawing CTDAOB-003-018. In common with this proposal, the proposed bridge would have a deck depth to finished road level of around 2.6m, which is greater than the original depth initially assumed in this study, and subsequently may have deck height, cost and landtake implications. Further design iteration and cost/benefit analysis would need to be undertaken to explore the relative merits of a thinner deck design at this location.

Access corridor C, Rail Land Option 4A

A bridge span of approximately 40m is required to cross the ECML and a span of approximately 35m is required to cross the sidings. For both of these options, braced steel plate girders in weathering steel is proposed, similar to the proposal shown on drawing CTDAOB-003-018, although it is expected that the girder spacing would be approximately 3m and the depth of the girders would be approximately 1.5m and allowing for the concrete and highway surfacing the final depth of the deck would be 2.0m, which is commensurate with the level initially assumed in this study.

Access corridor C, Rail Land Option 4B

A bridge span of approximately 100m is required to cross the ECML. For this option the tied arch solution as shown on drawing CTDAOB-003-017 is proposed. The depth of the bridge to finished surface level would be 1.9m.

Access corridor C, Rail Land Option 5 and 6

A bridge span of approximately 40m is required to cross the ECML is required for both of these rail land options. Braced steel plate girders in weathering steel is proposed, similar to the proposal shown on drawing CTDAOB-003-018 is suggested, although it is expected that the girder spacing would be approximately 3m and the depth of the girders would be approximately 1.5m. The final deck depth to finished surface level would be 2.0m.

6.6 Preliminary Scheme Costs

The preliminary scheme costs for the works are presented in Table 6.2. Optimism bias of 44% has been applied to the scheme costs based on guidance issued by the Department for Transport.

Table 6.2 Estimated Scheme Costs for Access corridor C (2011 Prices)

Description	Cost (£)	Cost (£)	Cost (£)	Cost (£)
Rail Land Option	1 to 3	4 (Option A)	4 (Option B)	5 & 6
Junction Improvement (Option 4) (from Table 6.1 already includes prelims and Optimism Bias)	16,096,357	16,096,357	16,096,357	16,096,357
Access corridor	3,657,870	3,187,133	2,972,489	2,781,236
Bridge Designs	27,124,317	10,754,831	14,550,654	7,354,407
Archaeology	125,235	125,235	125,235	125,235
Sub total (including General preliminaries, design and supervision costs and contingencies)	30,907,422	14,067,199	17,648,378	10,260,877
Optimism Bias @44%	13,599,266	6,189,568	7,765,286	4,514,786
Total	60,603,044	36,353,123	41,510,021	30,872,020

6.7 Design and Project Risks

The viability of any of the routes for access corridor C relies on the ability to form a new junction at Water End immediately to the east of Severus Bridge. Four proposals have been prepared to show various solutions. Each of these junction accesses rely on being able to construct part of the junction within land currently utilised as allotments at this location and in the north western corner of Millennium Green. If the land required for these improvements is not available or contested or third parties have to be approached to seek consent, the viability of the entire access corridor could be compromised.

All of the options for Access Corridor C rely on being able to cross the East Coast Mainline and other Network Rail operating lines at certain points, at the northern end of the site. To achieve such a crossing, the access corridor has to be significantly elevated above existing ground and track levels. This may meet with opposition from local residents and / or Network Rail.

No consideration has been made to the possible affects any structures may have on Network Rail's signalling infrastructure. If sighting distances are reduced/ impaired, re-signalling works may need to be undertaken.

Piled foundation details are indicative at present; a site investigation local to the final bridge's location would provide accurate assessment of the ground conditions. From previous site investigation reports undertaken in and around the site it is understood that there are peat and highly compressible soil layers in the vicinity. A piled solution therefore seems likely at this point.

A portion of the corridor to the north of the East Coast Main Line would be developed in the SFRA 1 in 1000 year flood zone as shown in Figure 6.3 below. The ground in this area is reasonably boggy and as well as a formal wetland, and informal wetland has developed. It is likely therefore that poor ground will be encountered during construction in this area and provides another reason for choosing a piled foundation solution for bridge foundations and the elevated corridor leading from Water End to the point at which the corridor crosses the ECML.

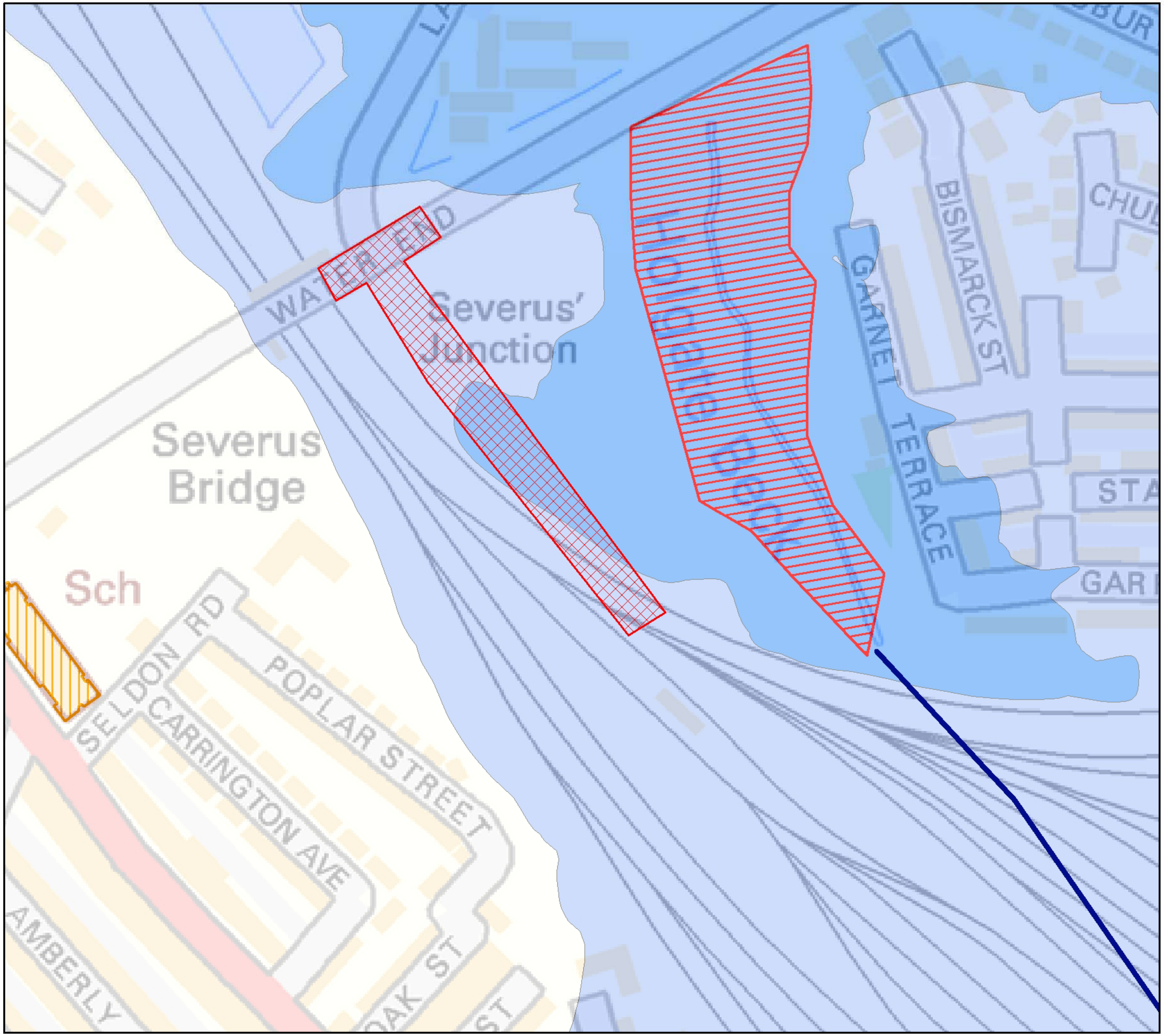
An investigation into the presence of any utility service providers buried infrastructure has not been made at this stage. Service diversions may be required following this activity.

The majority of the access corridors are to be constructed adjacent to live and significant rail lines. Contractor access to some of the proposed isolated parcels of land may prove problematical.

A summary of the principal project risks is provided in Table 6.3 and provides a useful table for further scheme development.

Table 6.3 Summary of principal design and project risks (Access corridor C)

Risk	Likelihood (Scale 1 to 5, where 1 is low probability 5 is high probability)	Impact (Scale 1 to 5 where 5 is high impact and 1 low impact)	Score	Mitigation
Network Rail approval for the bridge proposals	3	5	15	Establish early consultation with Network Rail
Excessive construction duration of structures restricts commercial attractiveness of development land	3	5	15	Dismiss high risk schemes
Proposed foundation design provide insufficient load bearing capability	3	4	12	Instigate surveys in the vicinity of the SFRA flood zone area.
Scheme meets with opposition from local residents owing to nature of elevated corridor above ECML.	3	4	12	Instigate consultation with local residents
Negotiations fail with potential stakeholders/landowners for junction at Water End.	2	5	10	Undertake further design work investigating the local access issues Look for early resolution on design. Instigate consultation with local residents, Network Rail and CYC Parks and Leisure.
Scheme affects utility apparatus	3	2	8	Instigate requests from utilities to understand what apparatus may be affected by the works.
Scheme affects Network Rail signalling equipment or meets opposition in respect of crossing of ECML.	3	3	9	Instigate early consultation with Network Rail to establish signalling requirements and crossing requirements of East Coast Main Line.
Areas of archaeological interest	2	2	4	Instigate early consultation with archaeological stakeholders.
Working areas for the construction of the access corridor and associated structures	3	1	3	Establish construction phasing and working areas via consultation with Network Rail and perhaps early contractor involvement.



Legend

- Existing Culvert
- Access Option C
- Tree preservation order
- SINC area
- Scheduled Ancient Monument
- Listed Buildings
- Conservation Areas
- Areas Of Archaeological Importance

SFRA Flood Zones

zone

- 1in1000
- 1in100 Nodefences
- 1in100 Withdefences 1/100
- 1in100 Withdefences 1/50
- 1in25 Developed Areas
- 1in25 Nodefences

CITY OF YORK COUNCIL

Halcrow Group Ltd
Arndale House
Otley Road
Headingley
Leeds
LS6 2UL

Halcrow

York Central Bridge Engineering Study Access Corridor C Site Constraints

Figure 4.5.

Drawn by: Pam Murray

Date Drawn: 15/03/2011

6.8 Buildability Assessment

The construction of the access corridors at Water End would in some cases pose significant or unusual engineering problems. Whilst the majority of the length of the corridors would be constructed on embankments or retained by structures, significant work has to be carried out between live rail lines, sometimes in areas of limited width and accessibility.

For the bridges the bulk of the buildability issues have been discussed earlier in this report as the majority of the proposals are similar to those presented earlier. Availability of sufficient land to enable the construction to proceed and the interface with Network Rail and its operations will be the major issue.

For Rail Land option 1-3 and the proposal for a cable stayed bridge spanning over live railway lines will require discussions with Network Rail for approval prior to construction. In addition, if the proposal is approved, the duration required to construct a tower, install the cables and the deck elements under possession is expected to be excessive.

Works adjacent to live railways and the overhead electrified lines are inevitable with this or any other form of structure provided at this location. The establishment of site boundaries, piling operations, excavation for pile caps, erection of temporary works to form the abutments and the deck construction will all require the contractor to work closely with Network Rail. All works will require Network Rail's prior approval, the use of pre-booked possessions and isolation of the Over Head Line Equipment.

6.9 Summary

This chapter has examined the engineering feasibility of constructing a new access into York Central via Water End.

The work has assessed options for a junction improvement which is much closer to Severus Bridge than previous designs. Having assessed a range of options the preferred option is a new roundabout. In comparison to the signal controlled layouts the provision of a roundabout does not require any modifications to Severus Bridge with the benefit of greater traffic capacity.

The differing Rail Land Options present alternatives for crossing ECML, Transfer Line, Warehouse Line and North Arrival. In total, 4 Access corridor Options have been considered, with two variations for the Land Rail Use Option 4 and an alternate proposal to access the smaller parcel of land that could be made available in Land Rail Use Option 3. Each of the corridors extends to a point within the site from which local development roads could then be constructed.

The estimated cost of the works ranges from £30.9 million to £60.6 million in 2011 prices.

The preliminary investigation and design work does not indicate there to be any major engineering issues associated with the access corridor. There are potential construction issues associated with the scheme options arising from the need to construct sections of the access corridor in parcels of land restricted in size and adjacent to live rail lines.

7 Leeman Road (Access corridors D, E & F)

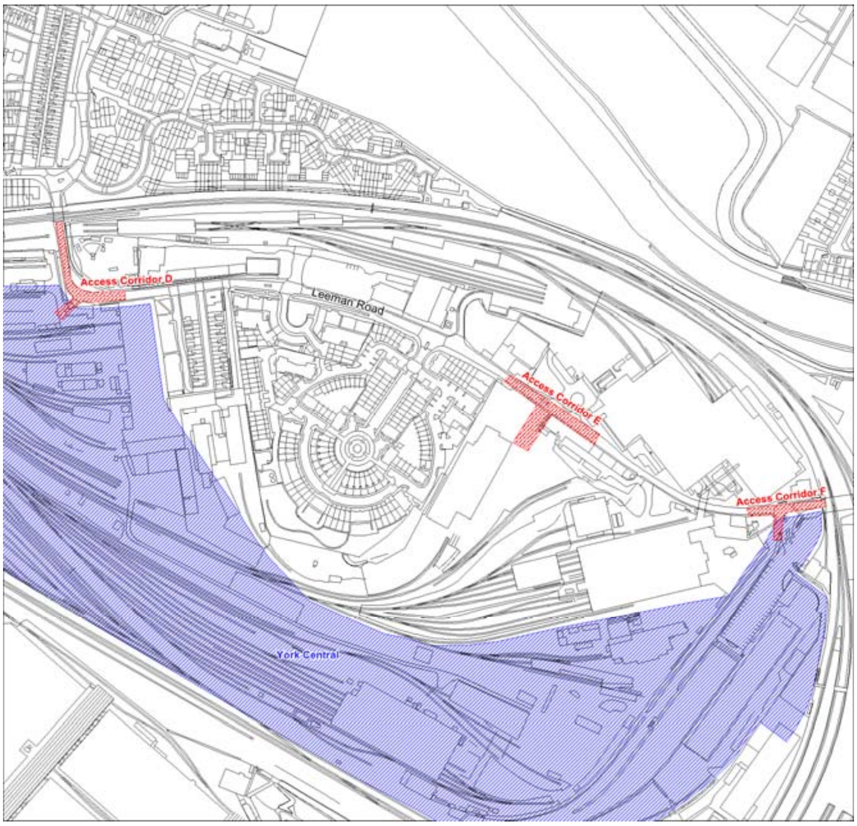
7.1 Introduction

Leeman Road to the immediate north of the development area provides the only current means of highway access into York Central. However, despite the accessibility Leeman Road affords it has a number of deficiencies which preclude it from being considered as a primary means of access into York Central. The main deficiency is the tight network of residential streets to the north of the ECML which would be adversely affected by extra traffic associated with any new development proposals. Other issues associated with Leeman Road itself include restricted bridge heights and weight restrictions.

Notwithstanding this it is feasible Leeman Road could serve pockets of new development to the north of the site and also act as means of access during the construction of the primary access corridors to the south and west. Providing access to these smaller parcels of land and realising development early within the overall construction of York Central will provide more immediate commercial returns for the developers. These commercial returns can then be reinvested to construct the more significant infrastructure to the south and west of the site.

The remainder of this chapter examines the feasibility of providing three secondary access corridors on Leeman Road. These locations are shown on Figure 7.1.

Figure 7.1 Access Corridor Locations D, E & F



7.2 Rail Land Options

The rail land options presented in Figure 1.2 impact on the viability of the access corridors. Table 7.1 provides an assessment of this issue.

Table 7.1 Rail Land Options and viability of Leeman Road Access corridors

Access corridor	Rail Land Option					
	1	2	3	4	5	6
D	N	Y	Y	N	N	N
E	Y	Y	Y	Y	Y	Y
F	Y	Y	Y	Y	Y	Y

Table 7.1 indicates access corridor D is not viable under Rail Land Options 1, 4, 5 and 6. Access corridors E and F are viable under all of the rail land options.

7.3 Existing Situation

Leeman Road (via Salisbury Road) connects Water End to the Inner Ring Road. There are two tunnels at either end of Leeman Road which restrict high sided vehicles. At the western end where Leeman Road passes under the East Coast Main Line (ECML) the tunnel is 11ft 3 inch and the residential area to north has a 7.5 tonne weight restriction. At the eastern of Leeman Road there is a tunnel under the northern edge of York Station. This tunnel, commonly referred to as Marble Arch, has a 12ft 6 inch height restriction and is approximately 85 metres in length.

Leeman Road has a mixture of land uses including the National Railway Museum, parking for the station and railway museum, new residential accommodation and in some instances derelict light industrial units.

Observed traffic surveys for Leeman Road showing hourly eastbound and westbound flows are shown in Figure 7.2.

Figure 7.2 Observed Traffic Flows on Leeman Road (18th November 2010)

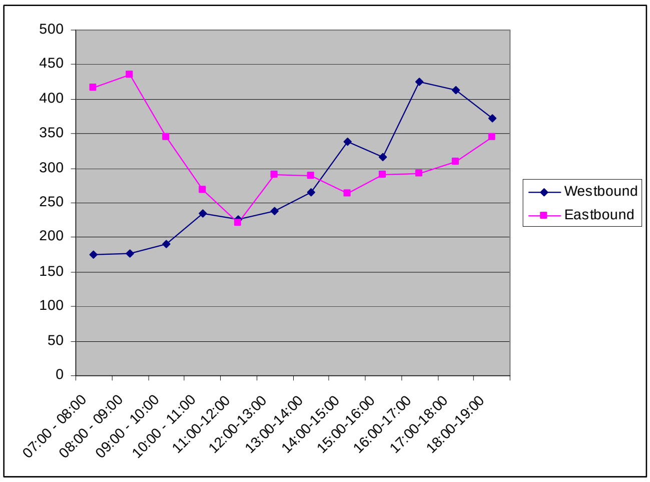


Figure 7.1 indicates tidal traffic flow patters. Eastbound flows, going into the City Centre are highest in the morning peak hour with approximately 440 vehicles and a similar flow is observed during the evening peak for the westbound flow out of the City.

7.4 York Central Masterplan

Previous masterplanning studies and transport strategies for York Central conclude that Leeman Road should be closed to traffic (except for emergency vehicles, buses, pedestrians and cyclists) in the vicinity of the National Railway Museum (NRM). This facilitates the creation of a new public square outside the NRM and addresses the deficiencies of the route as a major access corridor to York Central.

The phasing of these works is yet to be determined but it is likely the closure would be following the construction of one or two of the primary access corridors to the south and west of the York Central.

The York traffic model has been analysed to understand the approximate volume of traffic which uses Leeman Road as a through route and would be affected by the closure. The results of this analysis are presented in Table 7.2.

Table 7.2 Estimate of Leeman Road through traffic[2]

Time Period	Observed Flow		Estimate of through traffic - Number of vehicles (Percentage)		
	Eastbound	Westbound	Eastbound	Westbound	Total
08:00–09:00	435	177	225 (52%)	108 (61%)	333 (54%)
17:00-18:00	310	413	198 (64%)	194 (47%)	392 (54%)

Table 7.2 indicates that approximately 50% of the traffic is using Leeman Road as a through route to either access the City Centre or Water End. This traffic would be either displaced onto other routes or switch to other modes of transport not affected by the closure, for example, bus. Based on the current flow patters observed within the model the majority of the westbound through traffic is likely to reroute onto the A59 corridor. For displaced eastbound traffic vehicles are likely to be more evenly distributed between the A59 and A19 corridors as a means of accessing the city centre.

2 Through traffic is defined as traffic entering Leeman Road via Water End and exiting via Station Avenue or vice versa

The estimate on the displacement of traffic assumes that the internal highway network within the York Central sites does not facilitate any through traffic movements. It is also recommended that a comprehensive survey would need to be undertaken in order to substantiate the estimates provided in Table 7.2.

The displacement of traffic onto alternative routes provides an opportunity for development to be realised with no net growth in vehicle flows on the immediate local road network. Table 7.3 provides an estimate of the development quantum which could be realised.

The estimate of the development quantum in Table 7.3 has been informed by the Modal Assessment Trip Tool (MATT) developed by Halcrow. The tool derives person trip generation for the office and residential land uses before assigning a mode split based on the 2001 Census.

Table 7.2 Development Quantum broadly equivalent to current through traffic levels on Leeman Road during the morning peak period

Land Use	Volume	Car Arrivals	Car Departures	Total	Notes
Office (Option A)	45,000 sq m	325	26	351	Assumes City Centre mode split
Office (Option B)	35,000 sq m	316	26	342	Assumes mode split equivalent to west side of York (excl City Centre)
Residential	920 (units)	83	269	352	Assumes mixed private housing with mode split equivalent to the west side of York (excl City Centre)

Table 7.2 indicates that some 45,000 sq metres of office accommodation could be realised based on a city centre mode split target which is typically 37% by car. With a lower mode share by car (Option B) 35,000 sq m of office accommodation could be realised based on 46% mode share by car. Alternatively 920 residential units could be developed which would give an equivalent level of traffic generation.

Table 7.3 combines office (Option A) and the residential accommodation to given an indication of the relative proportions of each which would be equivalent to the through traffic levels. The assumption is that the office accommodation with the city centre mode share for car trips is focused around the rail station and the lower density residential accommodation further to the west. Further masterplanning and market analysis would need to be undertaken to establish the preferred mix of land uses which may also include ancillary retail and leisure.

Table 7.3 Mixed use development quantum equivalent to current through traffic levels on Leeman Road during the morning peak hour

Residential (units)	Office (Option A) Sq m
0	45,000
100	40,109
200	35,217
300	30,326
400	25,435
500	20,543
600	15,562
700	10,761
800	5,870
900	978

7.5 Access D

At access corridor D, an existing overbridge is located to the north of the proposed access point, which limits visibility to and from the junction. Furthermore to the east of the junction a crest is located on Leeman Road, this provides a level difference between the crest and access of approximately 3m and affects forward visibility of the junction. Another constraint is third party land to the north and east of the proposed access that limits the potential options that can be considered.

The layout proposed at this location takes into account these constraints and provides for a simple priority junction arrangement with localised widening to enable larger vehicles to traverse Leeman Road, plus entering and exiting the access corridor.

Access corridor D is shown on drawing CTDAOB-005-001 in Appendix E. The design includes the following features:

- provides off street cycle provision for left turning cyclists entering/exiting the development
- provides a priority T-junction arrangement into the development
- maintains existing kerblines where possible

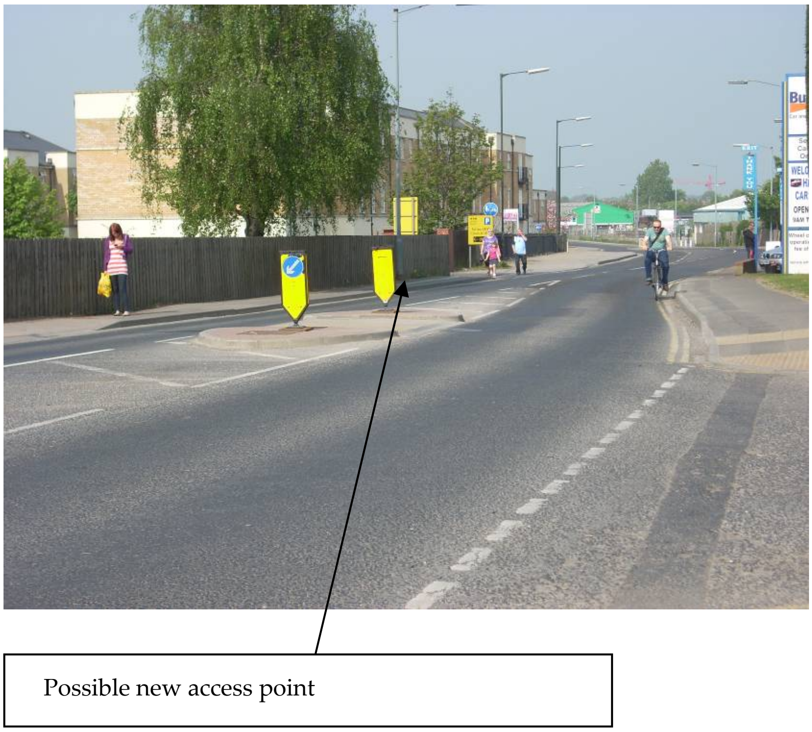
Plate 7.1 View from Leeman Road showing possible access point at existing Network Rail entrance

Computer modelling has been used to test the likely level of capacity and the potential number of trips that the junction can cater for based on existing flow patterns observed on Leeman Road. The analysis showed the junction design can accommodate development traffic in the region of 300 vehicles entering and 300 vehicles leaving the site during the morning and evening peaks. Whilst the modelling has demonstrated the junction can accommodate a high traffic flow scenario such large increases in traffic are not desirable at this location due to the impact on existing residential communities as discussed earlier.

7.6 Access E

At access corridor E there are few constraints. The proposed design is shown in Drawing CTDAOB-005-002 in Appendix E. The design proposes a simple priority junction which maintains existing kerblines where possible. Use of the existing access at this location was considered, however, it would leave a 5m wide strip of undevelopable land. By locating the access as shown the useable land increases by 25m thus becoming desirable space for a developer. In addition, the junction position shown has better visibility splays than the current position and providing the access closer to the central island improves pedestrian access. As with Access D computer modelling has been undertaken and the junction works adequately during the busy morning and evening peaks although this needs to be set in the wider context of the transport strategy and phasing of Leeman Road improvements.

Plate 7.2 View from Leeman Road showing possible access point on opposite side from existing petrol station and NRM access



7.7 Access F

At present the existing access is highly engineered providing an unattractive place for pedestrians and cyclists to traverse. The proposal for this location has been developed with the aim of providing a place where people are able to move more easily between York Railway Station, the development site and the National Railway Museum. To achieve this a number of constraints have had to be taken into consideration in the development of the option. These are:

- the close proximity to the Marble Arch tunnel restricts visibility to the right from the existing access;
- to the left of the junction significant quantities of guard-railing are located within the junction visibility zones which is compounded by a large sign blocking visibility to the left
- third party land bounds two of the three sides of the junction area, limiting possible improvement options
- to the south of Leeman Road, access to a private car park needs to be maintained as part of any scheme being developed

The proposal at this location takes into account these constraints and issues by proposing a 'Manual for Streets' style shared surface area, in which an enhanced environment is provided by removing non essential street furniture and easier crossing points across Leeman Road.

Plate 7.3 View from Leeman Road toward existing junction

In addition, an informal 'Square' is provided at the existing junction to reduce vehicle speeds on Leeman Road, with the aim of creating a space in which vehicles from all directions need to consider who has priority.

The design has been developed in such a way to maintain Bus and Emergency Service access through the tunnel, but to make it a place where only essential vehicles are permitted to traverse.

Materials provided should be of a higher quality than those normally used on highway schemes. The choice of materials should be selected to emphasise the different uses of the area and should be split into shared areas, overrun areas, dedicated vehicle areas and dedicated pedestrian areas.

The layout as a 'Square' cannot be modelled using conventional software packages, as such it is thought that the level of trips currently passing through the junction can be maintained with the new design.

Access corridor F is shown on drawing CTDAOB-005-003. The design includes for the following features:

- enhanced pedestrian and cyclist legibility through the area
- a shared surface area to improve the urban design of the area, plus enhancing pedestrian and cyclist crossing opportunities
- closure to through traffic within the tunnel underneath the ECML
- maintaining the tunnel for essential vehicles

7.8 Preliminary Scheme Costs

The preliminary scheme costs for the works are presented in Table 7.4. Optimism bias of 44% has been applied to the scheme costs based on guidance issued by the Department for Transport.

Table 7.4 Estimated Scheme Costs for Access corridor D, E and F (2011 Prices)

Description	Cost (£)	Optimism Bias (@44%)	Total
Access corridor D	£129,233	£56,862	£186,095
Access corridor E	£131,571	£57,891	£189,463
Access corridor F	£112,358	£49,438	£161,796

7.9 Risks and Buildability

The works proposed on Leeman Road do not present any significant engineering risks or buildability issues.

7.10 Summary

This chapter of the report has examined the feasibility of providing secondary access routes into York Central from Leeman Road. The junction improvements would facilitate access into small pockets of land to the north of the York Central development site.

Through traffic levels on Leeman Road are approximately 50% of the overall total flow. This traffic which is approximately 350 vehicles during the morning peak period would be displaced onto the A19 and A59 corridors as part of the York Central masterplan aspirations to create a new public square outside the NRM. As a consequence of removing through traffic, new development can be realised with no net growth in traffic levels in the immediate areas. This new development could be in the region of 900 new homes or 45,000 sq metres of office or a mixture of both. Whilst limited mitigation works would be required on Leeman Road to accommodate this level of traffic works would be required on the corridors affected by the displaced traffic levels. It should also be noted that the parallel radial corridors (A19 and A59) affected by the point closure are heavily congested and also exceed air quality management targets.

The junction improvement works will cost £186,095 for Access D, £189,463 for Access E and £161,796 for Access F.

The improvement works do not present any significant engineering or buildability risks.

8 Queen Street Bridge

8.1 Introduction

This section details the findings of a desktop study investigating the issues associated with demolishing the existing bridge on Queen Street and associated infrastructure adjacent to York Railway Station and replacing it with a new at grade road. In particular it discusses the issues involved in the demolition of the structure, the temporary traffic management required through the phase of the works and initial thoughts on a final layout. Figure 8.1 shows the location of the Queen Street Bridge on the York Inner Ring Road.

Figure 8.1 Queen Street Bridge Study Area

Plate 8.1 shows the view of the Queen Street and illsutates the level difference and the City Wall embankment.

Plate 8.1 View from Queen Street towards existing bridge, illustrating level differences and city wall embankment

8.2 Demolition and working areas

Demolition of this major route whilst maintaining traffic flow on a strategic link road within York city centre is a complex and challenging programme of works.

The works are covered by a number of guidance and regulatory documents. In terms of what is being considered here, demolition activities are covered under British Standard BS 6187:2000 "the code of practice for demolition". Traffic safety measures are considered within Chapter 8 of the Traffic Signs Manual "Traffic Safety Measures and Signs for Temporary Road Works and Temporary Situations". In addition health and safety aspects are considered within Construction Design and Management Regulations.

For demolition works to be undertaken safely all works need to be undertaken within an exclusion zone to ensure both personnel and the public are kept well clear of the works and safely away from any debris which may emanate from the site.

Where personnel are directly involved in the execution of the demolition works need to be within the exclusion zone they will be located in a position of safety which relates to the stage of demolition. This position will be assessed within an overall planned and monitored safe system of work. These personnel will not be permitted nearer the work than within the designated buffer area. Such work will only be permitted when it is inappropriate to work from outside the exclusion zone.

The extent of the exclusion zone is variable and dependent upon the demolition activity and rate of progress. The exclusion zone can also cover part of the site or even extend beyond the site boundary. In the latter case the consent of the adjoining owner(s) will need to be obtained. On sites which are restricted by space, e.g. city centre locations, the extent of the designed exclusion zones can be reduce in size, but only if adequate containment is provided. It should be kept in mind that any containment measures also require space and protection from traffic.

The exclusion zone will need to ensure that persons outside the zone are not harmed as a result of any demolition activity including any processing of materials. The harms that will be considered include physical, chemical or biological hazards and the effects of noise, vibration and dust.

The exclusion zone will need to form part of an overall managed health and safety regime and will be included in the method statements. The location of the boundaries of the exclusion zone are determined after assessing a number of parameters.

The work activity on site will be designed so that pedestrians and machines on site can move around without risk of collision. All machines will be provided with safe operating spaces. The use of plant and machinery such as excavators and cranes will be planned so that their operation does not present a risk to those nearby. In addition, the extent and location of the exclusion zone around the machine will take account of, e.g. a crushing hazard between part of the machine and stationary objects or structures, or inadvertent movement of the machinery. Pedestrian and machine movements on site will be controlled by designed and clearly delineated traffic routes that segregate their movements.

An appropriate exclusion zone will be instigated when any person can be at risk from, or as a result of, any demolition activity. Exclusion zones will be assessed and established for all types of collapse, irrespective of the method of demolition and size of the planned collapse. Each demolition activity will be individually assessed and new assessments will be made and used for different demolition activities and differing types of situation. Exclusion zones will be applied when a whole or part structure is being demolished and will include areas where demolition machines are operating, and where arising from the demolition can be deposited or otherwise handled, including controlled areas for soft strip materials. The areas which take up the Exclusion Zone are summarised in Table 8.1.

Table 8.1 Exclusion Zone Areas

Area	Description
Plan Area	The area of the structure or part of the structure that is to be demolished and is the subject of the assessment.
Designed Drop Area	The immediate hazard area, where the principal mass of the collapsing structure is designed to drop. Also included in this area is the plan area.
Predicted Debris Area	The perimeter of this second hazard area is the predicted limit or extent to which any debris from, or secondary material resulting from, the structure being demolished will travel and come to rest.
Buffer Area	Hazard area that is planned to allow for any unpredictable events. People should be safe from the effects of the demolition activity beyond the external perimeter of this area, which will also become the theoretical boundary of the exclusion zone.
Exclusion Zone	This is the combined area of: - plan area; - designed drop area; - predicted debris area; - buffer area.

The type of materials, their source and how the hazards maybe caused are summarised in Table 8.2.

Table 8.2 Hazards associated with demolition

Source of material	Area affected	Cause of hazards	Examples
Structure	Designed drop area	Gravity	Material from the structure dropping to ground or surface with little further movement
Structure	Designed drop area plus predicted debris area and possibly the buffer area	Gravity	Dropped material from the structure with onward movement including possible upwards trajectories; e.g. chimney rings, fire brick linings, other structure parts
Structure	Designed drop area plus predicted debris area and possibly the buffer area	Forced propulsion, e.g. by explosives, structural distortion, fluids under pressure	Fragments of structure such as pieces of steelwork, cast iron, rivet heads, concrete fragments of varying size, masonry, blast material, blast protection debris which eject from the blast area
Non-structure	Designed drop area plus predicted debris area and possibly the buffer area	"Slap effect" due to impact on landing area such as ground, hard-core cushion, fill area	lumps of earth, pieces of hard-core cushion, water surge; fragments of structures, such as pieces of steelwork, cast iron, rivet heads, concrete lumps, masonry ejected from the landing area

It is expected that the bridge will be removed by a method known as deliberate collapse. The extents of the designed drop areas and the predicted debris areas, the alignment of the line of fall and the allowed deviation from that line for structures will be determined by taking into account factors that include:

- the height to be felled
- any variation in cross-section, e.g. shape and wall thicknesses, through its height
- any apertures, e.g. flue entries at the base or in the height to be felled, including those that have been filled in (including the effectiveness of the infill)
- the extent of any deterioration of the materials
- the predicted break-up and fragmentation pattern of the structure as it falls
- materials that can become loose, such as roof top structures, or metal rings that can roll or be projected a further distance after the structure hits the ground
- break-up of the structure on impact, including potential for "fly" of material

- the surrounding environment

The final requirements for safe working zones will be based on the phasing of the works.

The overall phasing of the works is discussed later in this chapter, however the main elements of the demolition will be to start at each end of the existing structure and maintain single route over the bridge whist these initial sections of retaining walls are removed due to their proximity to properties and height of the existing retaining wall associated with the provision adequate exclusion and buffer zones.

Site access is generally proposed to be from the east of the site within land which is thought to be owned by Network Rail. The majority of plant and materials are proposed to arrive and leave via the east of the site. This traffic will use the existing access road alongside Hudson House to access Station Rise to join the wider highway network. There maybe a need for some safety measures at this location to ensure safe movements of site traffic and the public.

The proposed works are very close to the section of City Wall known as Toft's Tower. It will be important in removing the bridge and its associated infrastructure that the City Wall and any retaining structures required retain the historical "setting" of the walls.

Throughout the course of the works close monitoring of the city walls will need to be undertaken to ensure no movement or damage occurs due to the works. The works will also require Scheduled Ancient Monument Consent. The risks associated with this element of the works are summarised below.

Advance works will be required to facilitate utility apparatus relocation and protection. The exact nature of these works will need to be identified with the utility companies.

Site observations have shown that gas valves are located within bridge structure arches. These will need to be identified through C2 notices. Site observations also show sewer and water equipment located within the area adjacent to the bridge.

Telecommunication and Electricity are believed to be located either within/on the bridge deck. These need to be identified through C2 notices.

It is likely that in order to accommodate the Queen Street works that both temporary and permanent service diversions will be required for the following utilities; gas, electricity, telecommunications, cable, foul drainage, surface water drainage, UTC and water.

8.3 Permanent Works

Prior to removal of the bridge and its embankments works will need to be undertaken to ensure that the City Walls remain supported. Key constraints will be supporting the city walls, its embankment, limiting ground movements and preventing the destruction of unrecorded archaeology (if any). Given the limited information on the adjacent historical structures, it is assumed that the foundations to the City Wall are shallow, sit within the upper parts of the embankment and that they will be very sensitive to vibration and ground movements. On this basis, it will be assumed that support will need to be in-situ prior to demolition of the abutments/ approach embankments and that this support will need to be relatively stiff to minimise ground movements. It should also be assumed that there may be obstructions in the ground and advice on archaeological risks should be sought from a relevant specialist.

An embedded wall is therefore the only plausible option and the basic types are: sheet pile, king post, contiguous bored pile and secant bored pile. Ignoring archaeology, economics and aesthetics, Table 8.3 summarises the basic pro's and con's of these options.

Table 8.3 Summary of Supporting Structures

Wall type		Pro's	Con's	Notes
Driven	Sheet pile	Relatively thin. No arisings. Limits ground disturbance.	Flexible. Vibrations likely to be significant during installation. Obstructions will increase vibrations. Not appropriate if obstructions are significant. Will need anchors to support wall.	Unlikely to be suitable
	King post	Relatively thin. No arisings. Limits ground disturbance.	Flexible. Vibrations likely to be significant during installation. Obstructions will increase vibrations. Not appropriate if obstructions are significant. May need anchors to support wall.	Unlikely to be suitable
Bored piles	Contiguous bored pile wall	Relatively stiff. Should limit vibration and ground displacements. Unlikely to need anchors to support the wall. Can manage obstructions (up to a limited size).	Not appropriate if groundwater is an issue. Vibrations may be an issue if significant obstructions are encountered. Relatively thick wall. Significant arisings.	Plausible option, but only if groundwater is not an issue
	Secant bored pile wall	Relatively stiff. Should limit vibration and ground displacements. Should not need anchors to support the wall. Can manage obstructions (up to a limited size).	Vibrations may be an issue if significant obstructions are encountered. Relatively thick wall. Significant arisings.	Most plausible and safest option based on available information.

The assessment in Table 8.3 indicates that bored piles are the most appropriate retaining structure for the City Walls and embankment. A contiguous bored pile wall, which has a nominal gap between the piles, is a plausible option but only if the ground conditions are appropriate. The alternative is to use a secant bored pile wall which would comprise of a row of interlocking piles with soft cementitous piles placed in between hard reinforced concrete piles. Plates 8.2 and 8.3 give examples of a secant pile wall.

Plate 8.2 Secant Pile Wall (Musherieb Heart of Doha Phase 1B and 1C)

Plate 8.3 Secant Pile Wall (Paddington Station, London)

8.4 Traffic Management Arrangements

This section covers the initial considerations for the traffic management required to facilitate the diversion of the traffic, pedestrians and cyclists necessary to accommodate safe movements on Queen Street through out the duration of the demolition and reconstruction works.

Temporary Access Road

The scale and complexity and timescale of the project mean that the existing alignment of Queen Street will need to be closed during the works. There are two options available to accommodate the existing movement and access requirements:

- Divert all traffic on to alternative routes; or,
- Provide a temporary access road past the site using part of Railway Terrace and part of the land currently occupied by York Station car park.

The provision of a temporary road adjacent to Queen Street will require agreement from a number of land owners, as the route would need to pass across land which is currently being used for a variety of purposes.

The traffic volumes and strategic nature of the road mean that there will be a need to maintain two-way traffic along Queen Street for as longer period as possible through the duration of the works. This will reduce delays and congestion around the City by both minimising the need for single lane working or full closure of Queen Street. Table 8.4 below summarises movements along Queen Street

Table 8.4 Movements on Queen Street during the morning and evening peak periods

Vehicle Type	Time Period			
	AM Peak Hour		PM Peak Hour	
	To Station	From Station	To Station	From Station
Cars	634	456	440	579
Buses	46	48	47	48
HGVs	10	8	1	4
Cyclists	118	74	44	108

Table 8.3 shows that over 1,000 traffic movements need to be accommodated in the peak hour of which approximately 10% are buses.

The temporary road will need to be located so as to provide an exclusion zone for the demolition/construction works to include sufficient space to manoeuvre and operate safely.

It is therefore proposed that the temporary road around the demolition/construction site will utilise part of Railway Terrace (in front of the Railway Institute) to the south and an area of the existing "East Coast" York Station car park to the west. The road will rejoin Queen Street just south of the access to York Station. The proposed alignment of the temporary road is shown on Drawing No. CTDAOB-006-001 in Appendix F.

Due to the number of traffic movements at the entry to the York Station canopy, it is considered that the station drop off area should be designated for use by taxis only throughout the course of the works. This will mean that general station drop-offs will need to be relocated to the loop associated with the "Tea Room Square" area outside the Royal Station Hotel– this will require consultation with Network Rail and East Coast. Vehicle counts undertaken at York Station Taxi Rank in 2009 indicated that up to 50 waiting taxis may need to be accommodated at peak times. Within the temporary arrangements this level of provision will be difficult to accommodate. It is therefore proposed that the area under the station canopy is designated taxis only which would accommodate up to 16 vehicles in two rows with any additional vehicles accommodated with York Station car park. During the temporary works it is proposed that a dedicated area with a link between the station canopy area and the car park would be provided avoiding the need for taxis having to rejoin Queen Street in order to access the rank.

The ground conditions of areas which will provide the surface for the temporary road will need to be assessed in order to establish if any carriageway strengthening will be required to support traffic loadings for a period of up to 12 months.

Due to the nature of the temporary road and the timescales involved, the temporary road will require sufficient highway drainage and street lighting to ensure safe operation throughout the duration of the works.

At the transitions from the temporary road to the existing road alignment it will need to be ensured that adverse crossfalls of the carriageway are avoided as far as possible.

It is proposed that due to the reduced geometric standards of the temporary road and its proximity to the site that the speed limit along the temporary road will be reduced from the current 30mph on Queen Street to 20mph for the duration of the works.

The temporary road will have to provide sufficient sight-lines for through traffic to stop safely but also for side road junction visibility for Railway Terrace and the temporary station car park access.

Temporary fencing will need to be provided both to the site and to the York Station Car Park.

Pedestrian access to the York Dance Factory and other businesses located on the first floor of the Railway Institute is via Queen Street Bridge and the adjacent footbridge. In order to utilise Railway Terrace for the temporary road and to facilitate the removal of Queen Street bridge the proposals will require the footbridge to be removed. Consideration and consultation on the provision to access the first floor via the ground floor of the building, will need to be discussed with the occupants of the building. The ground floor is currently occupied by the CIU Working Men's Club.

The existing bus stand at the Blossom Street end of Queen Street currently used predominately by East Riding Buses, may need to be relocated during the course of the works.

Visibility for vehicles from the rear of the Railway Institute and from Queen Street Car Park, is limited the right at the junction with Railway Terrace. There will be the need to move the temporary road alignment slightly to the east at this location to improve the visibility.

There is a need to maintain pedestrian and cycle access at all times to York Station from the Blossom Street side of the station. Advisory on road cycle lanes will be maintained in both directions along the temporary Queen Street.

A footway will only be maintained on the western side of Queen Street along side the temporary road due to nature of the site area, and the demolition safety zones. In order to safely accommodate all pedestrian movements a temporary signalised controlled pedestrian crossing facility on Queen Street will be provided at each end of the temporary access road.

It is proposed that the area adjacent to the bridge on the eastern side of Queen Street will be used for the contractors site compound. Locating the compound here prevents site traffic having to cross the temporary road. The Network Rail pedestrian access by the bridge and under the City Walls will have to be closed through the course of the works with alternative access provided via Station Rise.

The residential properties on Railway Terrace are in close proximity to the planned works and proposed new layout, there are accessibility issues to consider for the residents through the temporary access and on completion of the works.

There are currently on street parking for the residents on both sides of the road, due to the disruption and limited space, consideration of temporary parking bays at an alternate location during the temporary works needs to be addressed. Also parking provision for the local residents needs to be taken into account in the final scheme design.

There is currently an access to rear of Premier Inn, adjacent to the Fleetways Taxi Company. The access leads to parking facilities for the hotel residents and access will be required during the temporary works and at completion of the works.

Diversion of Traffic

Queen Street forms a key element of the Inner Ring Road and closure will have a significant impact on the wider City network and access to the Bus/Rail interchange at York Railway Station.

The options for diverting traffic away from Queen Street for up to 12 months are limited by access to Micklegate with Micklegate Bar limiting access for larger vehicles. Any diversion route for goods vehicles would therefore have to incorporate a diversion using sections of the Outer and Inner Ring Roads. These routes and the traffic impact upon them will need to be considered during the future development of the scheme.

The programme of works discussed in the next section will require a closure of Queen Street for a period of up to four weeks to facilitate some of the demolition works.

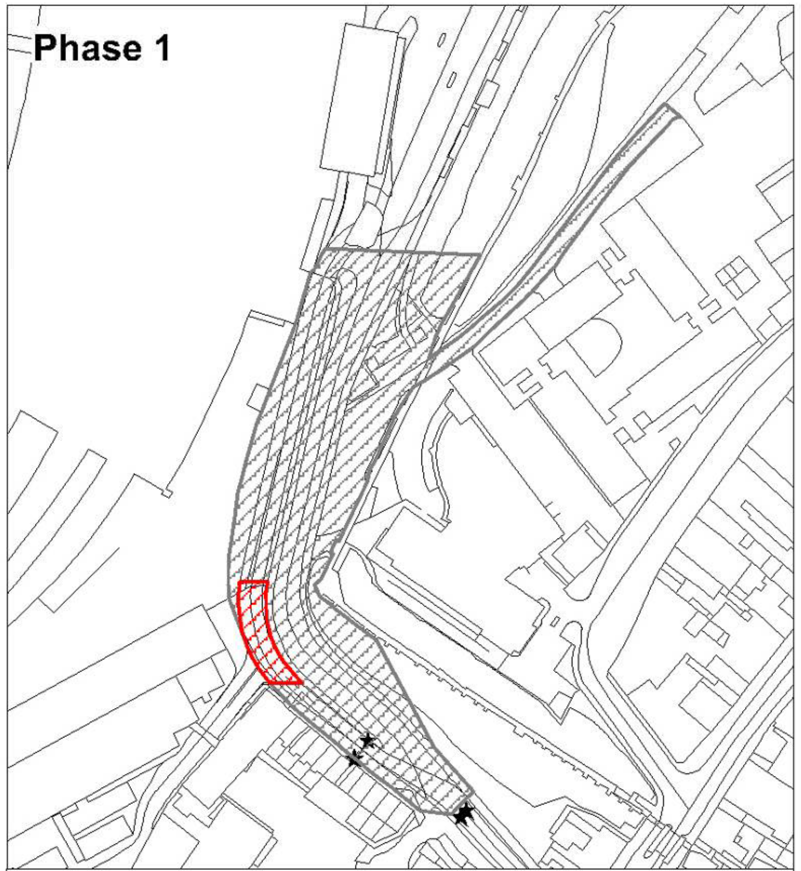
The bus network is key to the city at this location and need there is a very strong need for public transport interchange at the station.

Diversions for bus services may include the use of Nunnery Lane, Bishopgate Street, Tower Street, and Rougier Street (alternatively Skeldergate). Interchange for the railway station potentially being provided around Station Avenue, Station Rise and Rougier Street.

8.5 Overview of Programme of Works

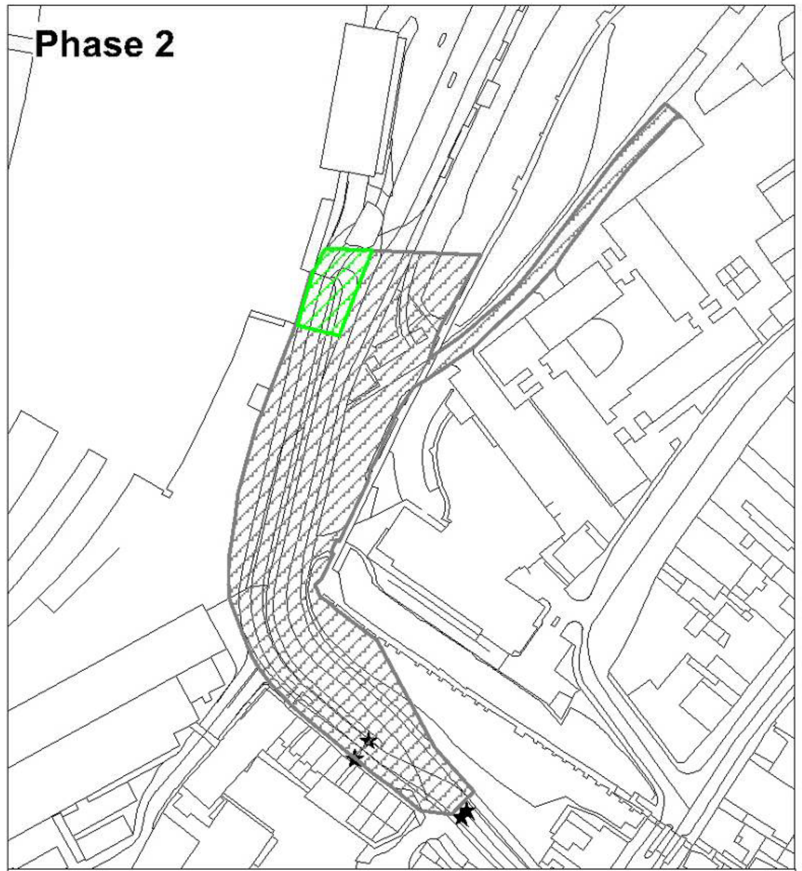
The works programme has been developed based on the need to provide for existing access and servicing requirements during course of the works. The need for safety exclusion zone adjacent to the Railway Terrace retaining wall section of the Queen Street Bridge means that there will be a need to close Queen Street close to Blossom Street for a period of four weeks. The key risks at each stage are identified within each works stage.

The key phases for the demolition and reconstruction works are summarised in Table 8.4 and are shown on Figure 8.2.

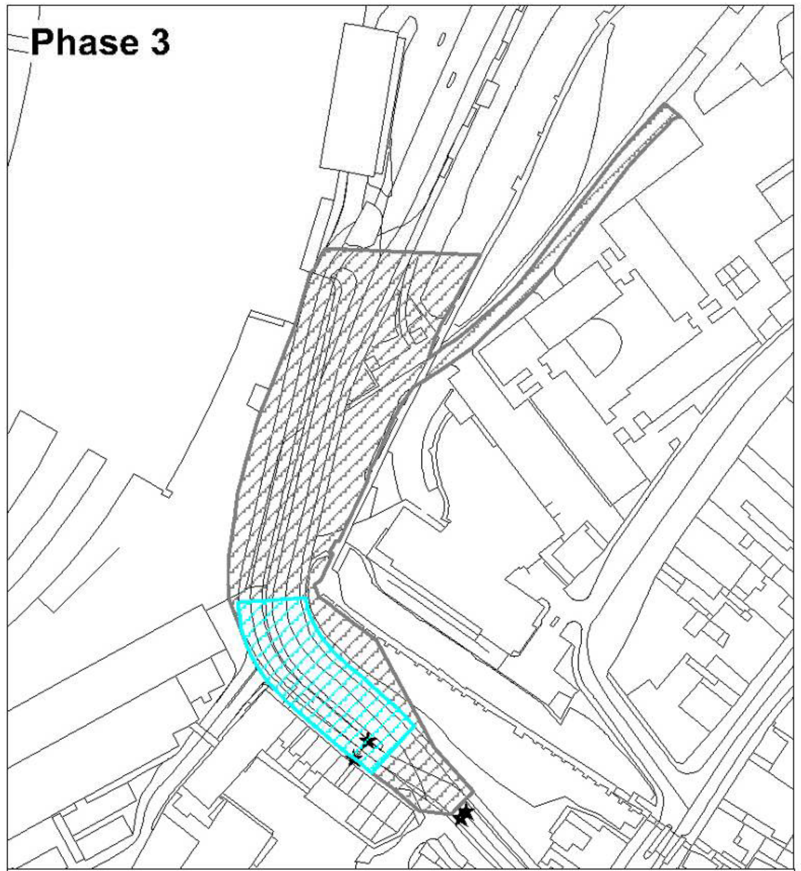


1A: Temporary diversion of utility plant (12 weeks)

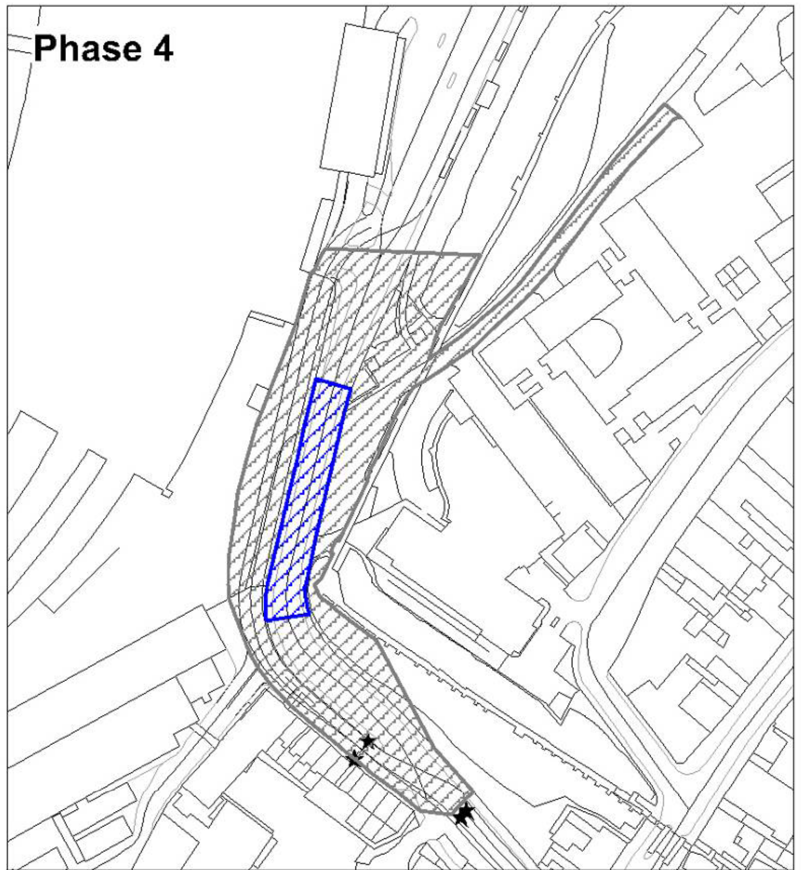
1B: Construction of temporary access road to Station car park and Railway Terrace (4 - 6 weeks)



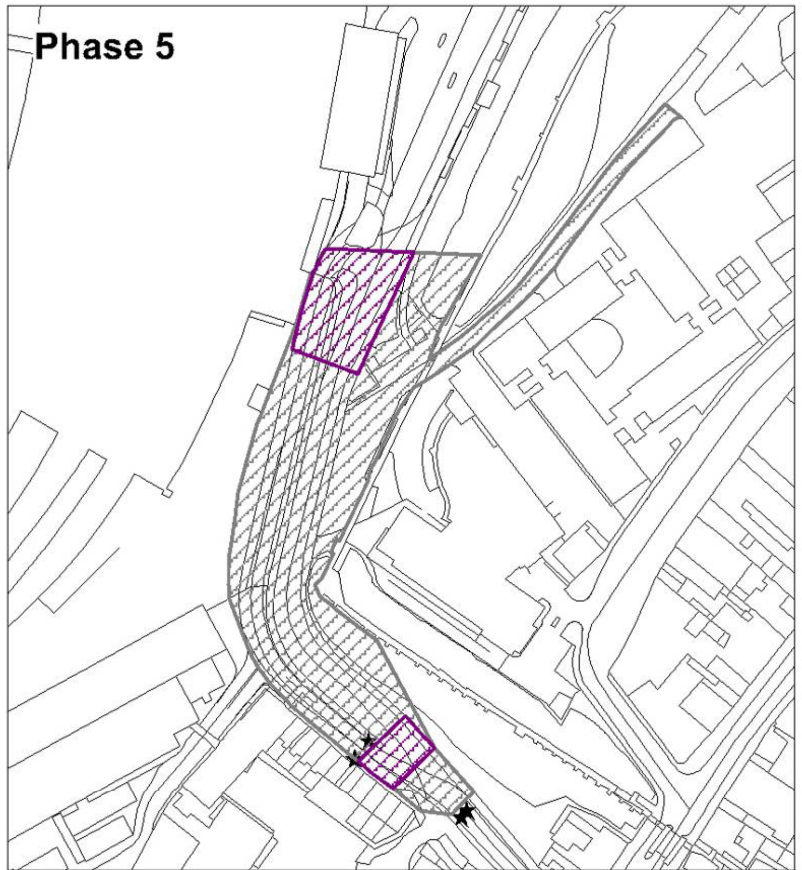
2: Construction of temporary access road at York station end of Queen Street (4 - 6 weeks)



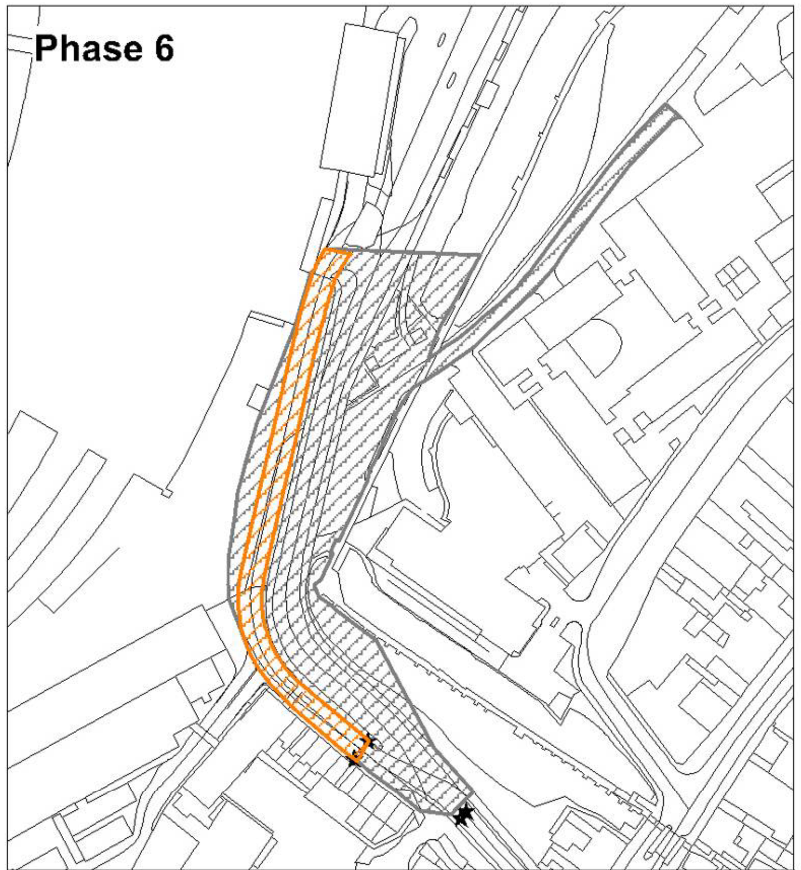
3: Closure of Queen Street to demolish bridge adjacent to Railway Terrace. (4 - 6 weeks)
Access to rail staiton car park and Railway Terrace via north end of station car park (4 - 6 weeks)



4: Demolition of Queen Street Bridge (4 weeks)
Permanent relocation of services (12 weeks)
Construction of new at grade Queen Street
Construction of new access to station car park
Two-way working of temporary access Road on Queen Street



5: Construction of tie-ins at each end of new access road
Possible need for night-time/weekend temporary traffic signals (combined 4 weeks)



6: Remove temporary road
Provide new layout of Railway Terrace
(combined 6 - 8 weeks)

Key
- Queen Street Study Area
- Phase 1 works
- Phase 2 works
- Phase 3 works
- Phase 4 works
- Phase 5 works
- Phase 6 works

CITY OF YORK COUNCIL

Halcrow Group Ltd
Arndale House
Otley Road
Headingley
Leeds
LS6 2UL

Halcrow

Project:
York Central Bridge Engineering Study

Drawing:
Queen Street Proposed Phasing of Works

Drawn by:	P. Murray	Date 23/02/11
Checked by:	S. Stamper	Date 23/02/11
Authorised by:	S. Stamper	Date 23/02/11

Drawing No.: CTDAOB 004 — Revision A

Drawing Scale:

Drawing reference: Figure 8.3

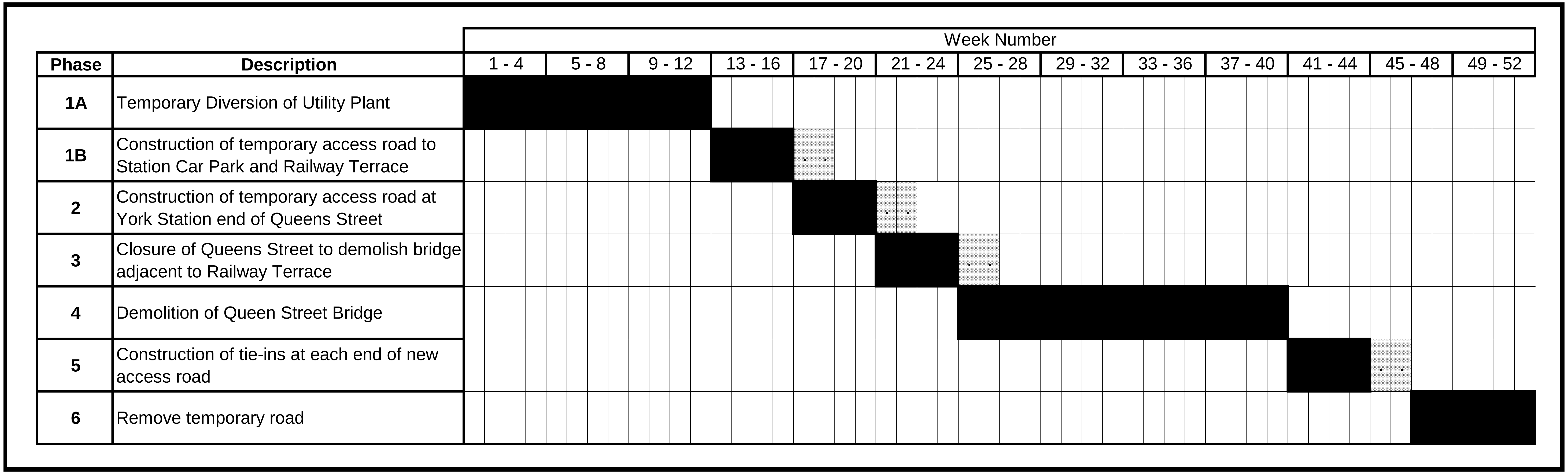
Table 8.4 Key Phases of the Queen Street Demolition Works

Phase	Description
1A	Temporary Diversion of Utility Plant
1B	Construction of temporary access road to Station Car Park and Railway Terrace
2	Construction of temporary access road at York Station end of Queen Street
3	Closure of Queen Street to demolish bridge adjacent to Railway Terrace Access to York railway station car park and Railway Terrace via north end of station car park.
4	Demolition of Queen Street Bridge Permanent relocation of services Construction of new at grade Queen Street Construction of new access to station car park Two-way working of temporary access road on Queen Street
5	Construction of tie-ins at each end of new access road Possible need for night-time/weekend temporary traffic signals
6	Remove temporary road Provide new layout of Railway Terrace

The overall works programme is expected to take 52 weeks from the start of undertaking the temporary diversion of utility plant. The programme for the works is shown on Figure 8.4.

Figure 8.3 Queen Street Bridge – Phasing Programme

Key
- Fixed Programme
. Possible Time Extensions / Savings



8.6 Works Phases and Key Risks

Table 8.5 below summarises the work phases outlined in Table 8.4 alongside the key issues and likely risk to the project.

Table 8.5 Demolition Phasing and Key Risks

Phase Description	Issues	Risk To Project
Phase 1A - Temporary Diversion of Utility Plant		
Temporary Diversion of Utility Plant	Type and scale of equipment, co-ordination of different	RED – High Risk
	Co-ordination of different companies	RED – High Risk
	Possibility of temporary diversion of services	RED – High Risk
	Temporary Traffic Management Requirement for Utilities	RED – High Risk
	Programme of works	RED – High Risk
Phase 1B - Construction of temporary access road to Station Car Park and Railway Terrace		
Set-up of Contractor Compound and access to Compound	Land Issues	RED – High Risk
Closure of pedestrian access to Hudson House alternative access via Station Rise and Toft Green	Land and Services Issues	RED – High Risk
Relocation/access to car park rental site	Need to provide alternative parking/ access	Green
Removal of Railway Institute 1st Floor access bridge	Issues with owner/tenants relating to current use and internal access issues/management	AMBER – Medium Risk
Access to Queen Street NCP Car Park	Need for alternative route and signing	Green
Removal of boundary wall	Ownership and temporary fencing to ensure security.	Green
Removal of resident parking on Railway Terrace	Temporary parking can be provided in station access.	Green
Barrier access internal layout of York Station Car Park	Power required to barriers and signing	Green
Develop cycle access point to station parking	Temporary access can be maintained	Green

Phase Description	Issues	Risk To Project
Phase 2 - Construction of temporary access road at York Station end of Queen Street		
Open Railway Terrace access to station car park	Residents experience additional traffic and pedestrian movements in front of properties	Green
Removal of section of bridge retaining wall	Taxis and traffic relocated. Some diversion of footways	RED – High Risk
Removal of station car park barriers	None	Green
Construct running surface for temporary road including footways and pedestrian crossings	Land, Utility Issues, and drainage of temporary road	AMBER – Medium Risk
Erect Temporary fencing to station car park	None	Green
Phase 3 - Closure of Queen Street to demolish bridge adjacent to Railway Terrace Access to rail station car park and Railway terrace via north end of station car park		
Closure of Queen Street to demolish bridge adjacent to Railway Terrace	Diversion of traffic	RED – High Risk
Temporary access to Queen Street and York Station car park provided	Land and Service Issues	AMBER – Medium Risk
Phase 4 - Demolition of Queen Street Bridge		
Demolition of Queen Street Bridge	Haul route via Station Rise	RED – High Risk
Piling adjacent to City Wall	Protection of Historical Monument	RED – High Risk
Permanent relocation of services	Programme	RED – High Risk
Construction of new road at grade Queen Street	Programme	RED – High Risk
Construct permanent new retaining wall	Protection of Historical Monument	RED – High Risk
Construction of new access to station car park	Confirmation of land ownership and availability	AMBER – Medium Risk
Two-way working of temporary access road on Queen Street	Confirmation of land ownership and availability	RED – High Risk

Phase Description	Issues	Risk To Project
Phase 5 - Construction of tie-ins		
Construction of tie-ins at each end of new access road	Possible need for night-time/weekend temporary traffic signals	GREEN – Low Risk
Possible need for night-time/weekend temporary traffic signals	Programme	AMBER – Medium Risk
Phase 6 - Reinstatement of Site		
Open new Queen Street alignment to traffic	Potential need for some traffic management to complete layout	GREEN – Low Risk
Remove temporary road	None	GREEN – Low Risk
Reinstatement of site	None	GREEN – Low Risk
Provide new layout of Railway Terrace	None	GREEN – Low Risk

8.7 Revised Highway Alignment on completion

The new alignment of Queen Street will be constructed at the existing ground level.

The road has been designed adopting the following geometric design standards set out in Chapter 3 of this report and is shown in Drawing CTDAOB-006-001 in Appendix F of this report.

The opportunity to significantly shift the road from the existing alignment is limited by the properties to the west of the road and the needs to provide access to these. These properties influence the road alignment for approximately the first 50m of the scheme and therefore dictate the curve alignment close to the city wall as the road rejoins the existing alignment outside the station frontage.

The final layout of the existing Rail Station car park and Queens Street car park is unknown at this stage and therefore the new alignment has been developed to accommodate these existing functions. If some of these areas, and the adjoining buildings, were to be redeveloped then during the course of the development of the area it would be possible to provide an alternative alignment and access arrangements. The alternative arrangement would be determined by access to the station car park area, Railway Terrace and pedestrian connectivity of the adjoining areas. It would be expected such changes will provide a significant enhancement over the current proposals which need to cater for a wide variety of often conflicting access requirements together with the needs for pedestrians to cross close to the station.

The re-grading of the ground level of the Queen Street, will lead to a significant level difference at the foot of the City Walls. In order to retain the embankment at this point it will be necessary to construct a retaining wall approximately four metres high at the foot of the existing City Wall. The height of this wall may be reduced, with some banking provided if the issues with the available space to realign Queens Street, which have been identified, can be addressed. Drawing CTDAOB-006-003 shows a cross section through Queen Street showing the existing and proposed vertical alignment of the highway.

The proposals as shown would provide one-way only access to Railway Terrace. A single priority controlled junction would then be formed on to Queen Street and this provides access to the Railway Institute, York Station car park, and to the station taxi waiting lane egress.

This layout leads to a very traffic dominated street scene. If the overall goals of the project are to be achieved there will be a need to address a number of the issues identified regarding access to adjoining properties and land. Given the emerging plans for the area it is recommended that a Maserplanning exercise is undertaken of the local area. This will ensure transport and land use planning are developed in harmony to meet the wider objectives of the City.

8.8 Further Work

The study has identified a number of areas which require further development and understanding. The development and greater understanding of the points highlighted are likely to remove or minimise some risks to the project currently identified.

- Discussions with Utility Companies;
- Detailed review of existing bridge structure including structure of approach ramps, obtaining as built drawings and undertaking trail investigations. This will enable the design/demolition team to fully understand the exact demolition phasing;
- An archaeological review of the site;
- Identification of precautions required when piling in and around the bridge and City Walls. These will be influenced by the type of piling technique to be adopted;
- Discussions regarding setting of new road and City Wall with City Strategy Departments;
- Discussions with a demolition contractor to fully understand techniques and timescales involved in removing the bridge. These discussions will be helped by a further understanding of the structure of the bridge and its approach ramps;
- Discussions with building and land owners regarding land required for scheme;
- Identification of any buildings to be demolished;
- Discussions with businesses and residents to understand any issues needing to be addressed both in temporary and final scheme design;
- Traffic modelling of impact of possible temporary road closures to understand impact on wider city road network.

- If a period of closure is required discussion will need to be held with both the Public Transport Team within City of York Council and bus operators.
- Discussion will need to be held with both the Taxi Licensing within City of York Council and taxi licence holder groups to discuss temporary and future provision for taxis at York Railway Station.
- Based on future use of the current York Station Car Park, Queen Street Car Park revisions to the proposed layout of the new at-grade Queen Street could be achieved.

8.9 Costs

The estimated costs of the works are presented in Table 8.6. Optimism bias of 44% has been applied to the scheme costs based on guidance issued by the Department for Transport

Table 8.5 Queen Street Bridge Demolition and Reinstatement Costs (2011 Prices)

Description	Cost (£)
Demolition works	880,124
Temporary Works (inc. Archaeology)	1,328,187
Works to Car Parks (Barriers)	64,009
Access corridor	1,518,292
Sub total	3,790,612
Optimism Bias (@ 44%)	1,667,869
Total	5,458,481

8.10 Summary

The demolition and reconstruction works are covered by a number of guidance and regulatory documents which manage the demolition and reconstruction process.

Undertaking this type of work on a section this major route whilst maintaining traffic flow on a strategic link road within York city centre is a complex and challenging programme of works. The traffic volumes and strategic nature of the road mean that there will be a need to maintain two-way traffic along Queen Street for as longer period as possible through the duration of the works. This will reduce delays and congestion around the City by both minimising the need for single lane working or full closure of Queen Street.

In addition due to the proximity of the works to York Railway Station a major public transport interchange mean that the needs of pedestrians, cyclists, bus services and taxis as well those of general traffic need to be taken into consideration.

The works programme of around 52 weeks, provides for existing access and servicing requirements during course of the works. The need for safety exclusion zone adjacent to the Railway Terrace retaining wall section of the Queen Street Bridge means that there will be a need to close Queen Street close to Blossom Street for a period of four weeks.

The study has identified a number of areas which require further development and understanding. These include a issues associated with the demolition of the existing bridge including utility diversions and archaeological issues; works associated with the temporary road including land ownership issues and accommodating all modes of transport with minimal disruption; and issues associated with the new road including setting and protecting the City Walls. An increased understanding of some of these issues will enable a number of the risks associated with the scheme to be addressed.

The opportunity to significantly alter the existing horizontal alignment is limited by the properties to the west of the road and the need to provide access to these. The final layout of the existing Rail Station car park and Queens Street car park is unknown at this stage and therefore the new alignment needs to be developed to accommodate these existing functions.

The demolition of the structure and reinstatement of the revised carriageway level is anticipated to cost £5.5M.

9 Conclusions

9.1 Introduction

This report has examined the engineering feasibility, land take and costs of providing new access corridors in the York Central development site. The report has outlined the risks associated with each option, examined construction issues and quantified the junction performance where the new highway interfaces with the existing road network. The study has also evaluated the engineering issues, traffic management arrangements and developed a programme of works for the demolition of the Queen Street bridge. This chapter of the report provides a summary of the investigations.

9.2 Infrastructure Costs

Table 9.1 provides a summary of the infrastructure costs for each of the rail land options.

Table 9.1 Summary of Infrastructure Costs for each Rail Land Option

Rail Land Option	Primary Access corridors			Secondary Access corridors		
	Chancery Rise	Holgate Park Drive	Water End	Leeman Road		
	A	B1 / B2	C	D	E	F
1	£9.2M	£14.4 / 17.6M	£60.6M	NA	£0.2M	£0.2M
2	£9.2M	£14.4/ 17.6M	£60.6M	£0.2M	£0.2M	£0.2M
3	£9.2M	£14.4/ 17.6M	£60.6M	£0.2M	£0.2M	£0.2M
4	£9.2M	£14.4/ 17.6M	£36.4 – 41.5M	NA	£0.2M	£0.2M
5	£9.2M	£14.4/ 17.6M	£30.8M	NA	£0.2M	£0.2M
6	£9.2M	£11.4 / 11.5M	£30.8M	NA	£0.2M	£0.2M

At £9.2M Chancery Rise has the lowest estimated costs of the primary access corridors. The lower cost reflects the short rail span and favourable ground elevations at this location.

Holgate Park Drive is estimated to cost in the region of £11.4 to £14.4 for options on the eastern side of the Five Acre Site. The infrastructure costs on the western side are higher and range from £11.5M to £17.6M. The higher costs reflect the longer bridge spans for these Rail Land options.

At Water End there is significant variation in cost, ranging from £30.8M for Rail Land Options 5 and 6 to £60.6M for Rail Land Options 1 to 3. The significant increase in costs in comparison to Holgate Park Drive and Chancery Rise reflects the ground elevations and bridge spans with a requirement to provide significant bridge structures and viaduct requirements to access the York Central site.

The infrastructure costs associated with Leeman Road are very small in comparison to the primary access corridors.

9.3 Land Take

The primary access corridors will be 16.3 metres wide with additional areas of land reserved for landscaping and future highway requirements. To provide sufficient clearance of the rail lines on entering York Central the road level will typically be 7 metres above the existing ground levels. Using a 6% gradient the highways are generally 150 metres in length before they return to typical ground elevations within York Central.

On entering York Central two options have been explored for ramping the highway down to existing ground elevations. The first option is to provide a conventional highway which is aligned such that it makes best use of the available rail land parcels. The alternative is to provide a roundabout immediately on entry to York Central and combine this with a ramped highway. The latter option which has similarities to a recent development scheme in Middlesbrough provides greater flexibility to skew the highway such that it no longer dominates the central and most commercial areas of the York Central site. This issue is more prevalent at Chancery Rise where the new highway will interface more with the urban quarter proposals.

To return the highway and footway to typically ground elevations within York Central requires 2,500 m^2 of land. If the roundabout design is adopted the footprint of the highway increases to 4,000 m^2 of land. The cumulative area occupied depends on the embankment system adopted within the designs. To maximise the developable areas of land retaining walls can be used which will enable development to front immediately onto access corridors. The feasibility of this will need to be explored on the development of the site masterplan but adopting this approach will further enhance the integration of the York Central site within the overall fabric of the City. If a less intensive development approach is adopted earth embankments could be used and on average an additional 2,300m^2 of additional land will be needed. A further 1,300m^2 of land is required for the earth embankment for the roundabout designs.

9.4 Engineering Feasibility

The various alternatives for providing highway access corridors from the surrounding highway network into York Central do not pose any particular engineering difficulty, but some solutions do provide a greater degree of complexity than others.

The design of each corridor can be achieved to the standards outlined in Chapter 3 of this report, but not always with sufficient clearance of the rail lines as the case for Holgate Park as reported in Section 5.4.

If proposed land usage dictates a lower level of landtake, derogation of design standards could be sought from CYC in order to increase gradients, for example, that would reduce access corridor lengths. Similarly, the same derogation in standards could be sought if more clearance above the rail lines is required by Network Rail.

The landtake arising from earthworks could also be reduced by the introduction of significantly longer sections of retaining wall.

In some instances, for example, at Water End the working room available may pose some level of difficulty, but the risk of this during construction could be alleviated by early contractor involvement, discussing methods of working and possessions to ensure the proposals are feasible.

Ground conditions are not considered to pose any significant difficulty and where any such problems are believed to occur it is believed that piled foundations, surcharge of existing ground (in embankment construction) and alternative modern forms of construction (such as polystyrene block construction in lieu of embankments) could overcome such problems. Such methods of construction are however likely to increase the scheme costs.

The engineering proposals, may in some instances, give rise to increased traffic noise levels or result in visual intrusion at some residential areas (such as Cleveland Street and Garnet Terrace). Careful consideration of the engineering proposals should allow mitigation in such cases. For example, the construction of the elevated access corridor from Water End on a retained earth structure, as opposed to a pier supported one with appropriate levels of landscaping, could give rise to an enhanced visual outlook from Garnet Terrace as significant lengths of rail line would be obstructed and may result in mitigating rail traffic noise to these properties.

9.5 Chancery Rise

The pros and cons associated with each Access Corridor are discussed in further detail below:

- The existing highway at this location provides a convenient access corridor toward the bridge crossing of the rail lines into the development site.
- The highway alterations to the existing junction do not present any particular engineering difficulty. However, such modifications could have an adverse effect on the traffic flows in this area and will require careful traffic modelling within the wider highway network in order to ensure that such modifications do not result in adverse effects to the highway network.
- The bridge crossing of the sidings and FAL do not pose any particular engineering problems; possessions would be required but are not considered onerous owing to the low frequency of rail freight traffic.
- At this level of investigation, no particular issues in connection with ground conditions are known.
- The location of this access would provide good construction traffic access and construction compound opportunities.

9.6 Holgate Park

- Future Network rail plans to develop additional sidings in the plot of land to the west of the Thrall works could significantly jeopardise the viability of providing an access corridor from the existing highway network into the development site.

- Modifications to the existing roundabout(s) do not present any particular engineering difficulty. However, as with highway improvements at Chancery Rise, traffic modelling of the existing traffic signal controlled junction, in the context of the wider highway network would be required in order to ascertain that additional development site traffic does not cause problems at this location or those further afield.
- Again, the bridge crossings of the sidings and FAL do not pose any particular engineering problems, but as reported in Section 5.4, adherence to the design standards set out in Section 3 results in insufficient vertical clearance of the FAL and may likely require a departure from standards to achieve the nominal 5.8m clearance or alternatively a less efficient bridge deck design.
- At this level of investigation, no particular issues in connection with ground conditions are known.
- The location of this access would also provide good construction traffic access and construction compound opportunities.

9.7 Water End

- The actual modifications to the existing highway to form a new junction do not present any particular engineering difficulty. Again, traffic modelling of the wider highway network is recommended in order to ascertain that additional development site traffic does not cause problems at this location or those of adjacent junctions.
- Whilst none of the junctions or access corridor solutions are considered to present engineering difficulty, it would be fair to summarise that most provide a degree of complexity.
- The length of highway from Water End to the ECML is elevated on a viaduct which results in a high cost solution (compared to earthworks or retained structure) and inherently more complicated to construct.
- Construction work in the Millennium Green area may be disruptive to this environment during the construction period and may require significant remedial landscaping proposals and careful management and mitigation during construction.
- Much of the land to the south of Millennium Green is very boggy in nature and is likely to result in added complexity in respect of the design and construction of the viaduct piers.
- Many of the options for this corridor rely on being able to access small development plots, confined by existing rail lines. This does provide an added degree of difficulty and complexity in engineering terms but is not an insurmountable issue.

- Whilst other corridors do cross rail lines, these are predominantly infrequently trafficked sidings and the FAL. This corridor has the added complexity of bridging the much more frequently trafficked ECML. The nature of the possessions required in order to bridge over this line may add a significant length of time to the construction programme, but again this factor is not one that cannot be overcome.
- Site accessibility for construction traffic is likely to be more complex for this access corridor than for others, owing to the isolated nature of the development plots. Construction traffic would have direct access from Water End to this area of the site via the existing access road but it is likely that some form of temporary works to widen or strengthen the access road would be required.
- No direct access to a construction compound from Water End would be possible, assuming that such could not be established within Millennium Green.

9.8 Queen Street

The demolition of the Queen Street bridge whilst maintaining current access arrangements is a complex and challenging programme of works. The anticipated works programme is around 52 weeks which assumes existing access and servicing arrangements are maintained for the majority of the works. There will however be a need to close Queen Street for approximately 4 weeks whilst one stage of the works is being undertaken.

A comprehensive masterplanning exercise is required in order to better understand the revised highway alignment on completion of the works. The removal of the bridge would open up the area to the south side of Queen Street and improve the overall appearance and setting of the City Walls.

The demolition of the structure and reinstatement of the revised carriageway level is anticipated to cost £5.5M.

9.9 Access Corridor Further Work

In respect of further work that may be required or may be advantageous, it is appropriate to consider what would be gained by such study.

In the preparation of this study, limited consultation has taken place with Network Rail in respect of the proposals. Each of the Access Corridors A to C would impact upon the rail network and it would therefore be extremely beneficial to begin consultation with Network Rail prior to undertaking any detailed design. Such consultation may influence a preferred route.

Land purchase negotiations with Network Rail and other York Central landowners need to be undertaken as soon as possible as the outcome of such discussions will most certainly dictate which of the access corridors is feasible.

Such discussions should also include Network Rail supervision in respect of structures crossing rail lines and the cost of providing this and possessions.

Consultation with local residents as may be affected such as at Cleveland Street and Garnet Terrace would also be useful in addressing resident concerns at as early a stage as possible. This process may again influence a preferred route.

Many of the access corridors may impact upon the existing Holgate Culvert running through the site. Any surcharging of existing ground, site clearance and demolition activity and piling operations could affect this structure. A structural condition, line and depth survey of this Culvert is likely to be advantageous prior to the commencement of detailed design.

This study did not include for the assessment of existing and proposed noise and / or air quality conditions. It would be advisable to undertake such detailed assessments to ensure that detailed design accounts for any possible issues, such as an increase in road traffic noise or worsening of air quality.

As identified in the tables of "principal design and project risks" for each access corridor, confirmation of the location of existing statutory undertakers equipment and any impact upon them should begin as soon as possibly feasible. Again this information may have an influencing factor in deciding the route of an access corridor prior to undertaking detailed design.

A more comprehensive assessment of levels is required in certain locations to supplement the information available for the York Central site. It is essential that these surveys also establish the level of the rail lines.

Further traffic modelling is required to better understand the effects of the junction improvement works and development traffic flows on the local highway network. Micro-simulation models have already been developed for the areas affected by the Access York proposals and these provide a useful reference point for these assessments.

An assessment of contaminated land ought to be undertaken to comply with any requirements as may be dictated by current legislation and determine any risk to workforce.

Many of the access corridors pass through the location of existing structures. A competent survey of these structures should be undertaken, to include the identification of asbestos, particular methods of demolition, particularly adjacent to live rail and roads, impact upon the construction programme of any such activity and also of course to asses cost and possible recycling of materials.

Appendix A

Rail Land Options

Halcrow

Appendix B

Access corridor A (Chancery Rise)

Appendix C

Access corridor B (Holgate Park Drive)

Appendix D

Access corridor C (Water End)

Appendix E

Access Corridor D, E and F (Leeman Road)

Appendix F

Queen Street

Appendix G

Infrastructure Cost Estimates

Halcrow