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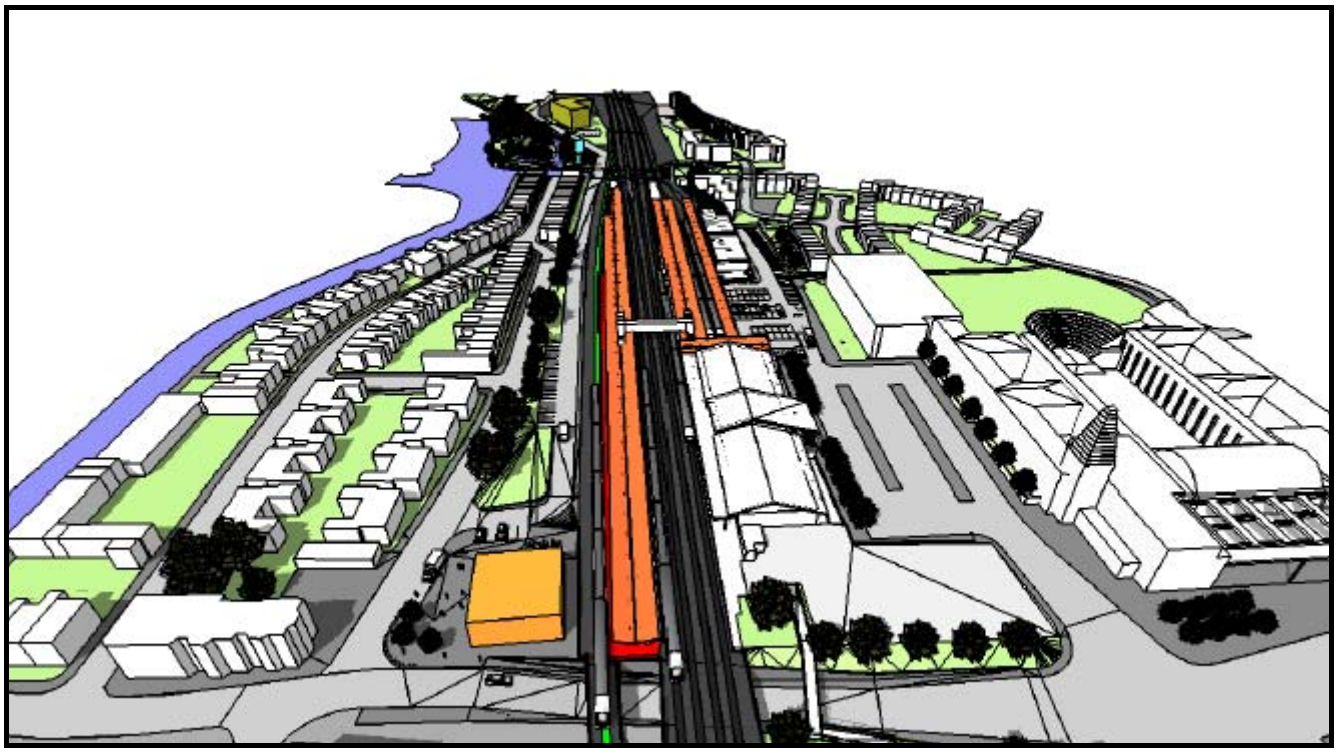
Network Rail

W1002B Oxford Corridor

Oxford Corridor CP5 - Phase 2 Option Selection Report



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Definitions

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Abbreviations

CPO	Compulsory Purchase Order
CS	Configuration State
DCL	Didcot and Chester Line
ELR	Engineering Line Reference
EWR	East West Rail
GWEP	Great Western Electrification Programme
GWML	Great Western Main Line
HLOS	High Level Output Specification
Jn	Junction
OARS	Oxford Area Resignalling Scheme
OXD	Oxford Branch (Bletchley Bay Platform - Oxford North Junction)
TVSC	Thames Valley Signalling Centre
TWAO	Transport and Works Act Order
WCML	West Coast Main Line
YHA	Youth Hostel Association

1 Introduction

Network Rail have commissioned Tata Steel Projects to undertake a GRIP3 AIP study into the Oxford Corridor CP5 works. Oxford Corridor CP5 has been split into Phase 1 and Phase 2.

Due for implementation in February 2016, the Phase 1 works could be summarised as follows:

Engineering works to enable East-West rail services into Oxford Station, remodelling of Oxford North junction, renew Oxford North Station ladder, support OARS implementation, enable GWEP implementation, and provide enhanced standage in the Up and Down sidings North of Oxford Station.

Tata Steel Projects are currently undertaking AiP submissions for Phase 1 with delivery during Q4 2014.

The purpose of this report is to further explore the scope of Phase 2, arriving at a position of Option Selection. This will enable the commencement of an AiP study, with delivery anticipated in Q2 2015.

1.1 Oxford Corridor CP5 Remit

Extract from Network Rail PRS – March 2014:

*The objective of the scheme is to improve capacity and capability on the "Oxford Corridor" (the Corridor) to meet the **HLOS** objectives for increased train service capacity and journey time improvements.*

*The identified options also align with the objectives of the joint Oxford City Council and Oxfordshire County Council / **NR** Masterplan for the Oxford Station area.*

*The Corridor links the **GWML** at Didcot North Junction with the London Marylebone to Birmingham "Joint Line" at Aynho Junction (South of Banbury) and leads on through Leamington to join the **WCML** at Coventry.*

*The Corridor includes the junctions at Wolvercote to the Cotswold Line and at Oxford North to the Bicester Line. It follows the rivers Thames and Cherwell through Oxford and Banbury and is signalled from the panel signal box at Oxford. The Western Route section of "the Corridor" will be re-locked and re-controlled from **TVSC** in 2015.*

The Corridor is double-track from Didcot (North Junction) to Aynho Junction with some three & four-track portions between Kennington Junction and Wolvercote Junction and through Oxford station.

Diversionary route potential is very limited on the Corridor and maintenance opportunities are severely restricted by existing uni-directional signalling with almost non-existent single line working potential.

*The Corridor provides the key strategic link for passenger and freight traffic between the south coast and the **WCML** and north, in addition to acting as a branch of the east-west **GWML** for outer Thames Valley and Cotswold Line traffic.*

In addition to Oxford City regeneration proposals the City & County councils have aspirations to widen the road under Botley Road Bridge and improve safety for cyclists and pedestrians.

*In a letter dated 2nd April 2013 the **DfT** confirmed that **NR** should generate options to increase the dimensions of Botley Road Bridge to permit highway improvements in any works that are done as part of this project to the bridge.*

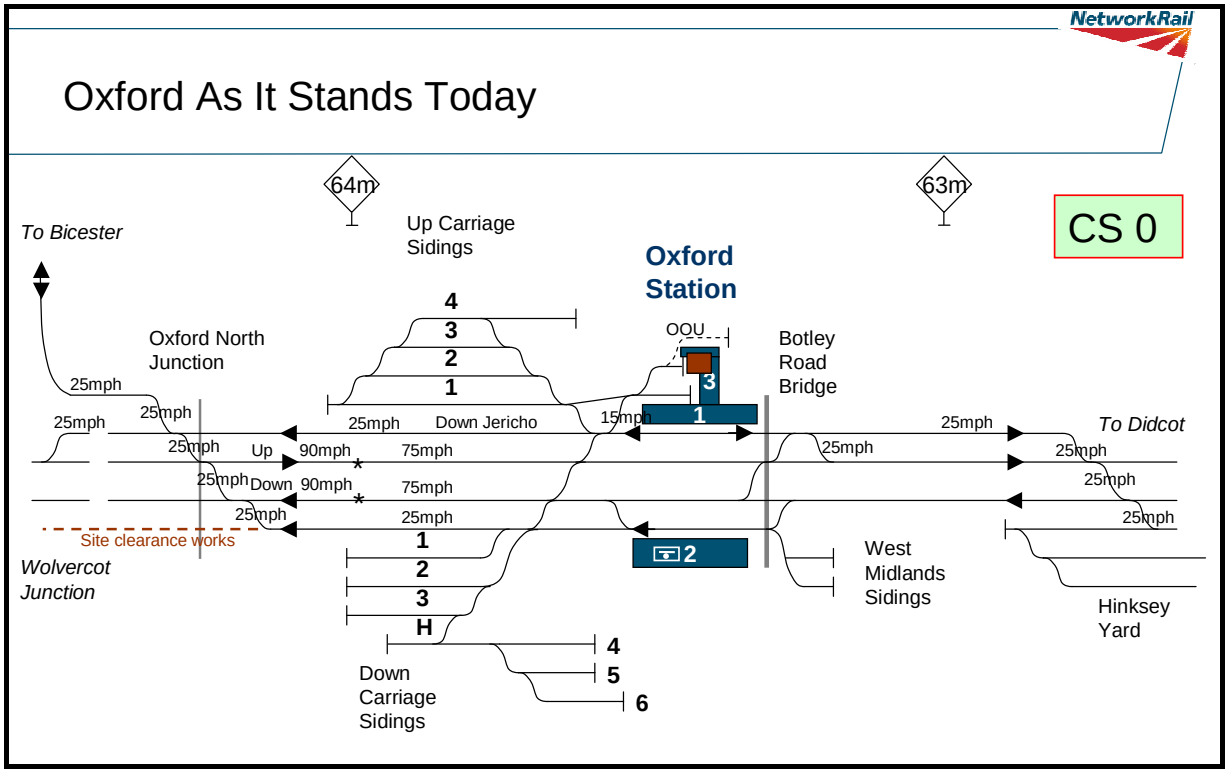

Figure 1 PRS Extract, existing Oxford Corridor Layout

1.2 Oxford Corridor CP5 Phase 2 Scope Elements

Extract from the NR PRS March 2014.

- *Oxford Station - provide a new down-side twin-face platform with turnback route to the Up Main over a new trailing Main-Main connection incorporating parallel moves – provision of a new through-service Platform at the rear of an extended existing platform 2 to support an additional two trains per hour service between Reading and Oxford and the Banbury line. It is acceptable to remove the two 'West Midlands' (Cemetery) sidings immediately south of platforms. Entrance speed in the down direction to this new platform face loop to be optimised for minimum journey time nominally 50mph.*
- *Increase of turnout speed on entry to the Down loop (existing platform 2 face) to 30mph.* [Incorporated within Phase 1].
- *Plain Line steel sleepered section containing Botley Rd, 253b, 233a and the River Isis **U/B**, between the Nth end of Plat 1 to the new 75mph turnout at Hinksey Nth.(known to have sub-standard ballast).* [Incorporated within Phase 1].
- *Oxford North **Jn** – doubling of the junction connection to support the **EWR** use of any platforms, with parallel routes available to the Bicester line. This junction speed should be reviewed against the geographical constraints of the curve to Wolvercote tunnel, the*

fastest train attainable speed given the proximity of the station platforms one mile distant and the platform connection speeds. [Incorporated within Phase 1].

- *Upgrade of the Up loop exit connection to 75mph at Hinksey Nth. Recovery of the Main-Main and Up Main – Up Loop connections (235/238 points). Upgrade of the facing crossover at Hinksey North to 40mph.* [Incorporated within Phase 1].
- *A passing loop of minimum 775m standage will be required on the section of line between Oxford North **Jn** and Woodstock Rd **Jn**. At the Woodstock Rd end this will be formed by a trailing connection and signals to be constructed by the EW Rail project (mileage to be advised). A facing connection on the branch line will be required between the Oxford North **Jn** protecting signal and the **Jn** itself. This crossover (nominally at 40mph) will be incorporated into the design of the connections. The protecting signal may need to be relocated.*
- *Botley Road Bridge – improve the carriage way / pedestrian capacity of the existing Botley Road Bridge at the south end of Oxford Station as described in Appendix H. The final option shall include passive provision for an Up Side Island platform and additional through platform line. The carriageway plus cycleway and footpath has been specified at a min 19.2m span by Oxford City Council and the depth of the Bridge/Carriageway must be at least 4.8m.*
- *The provision of 3-minute headways between Didcot (excl) and Oxford (incl) to support the Freight capacity project requirements. The **OARS** project will make limited passive provision for 3-minute headways south of Oxford Station. However, the extent of this will need to be clarified through further integration with the **OARS** project.*
- *A **TWAO** will be required to achieve Property consent on the West side of the Oxford Station throat (from Cemetery Road/Osney Lane Footbridge to Castle Mills Stream Bridge inclusive) for which a Consents Manager will be required. East side developments which are being actively provisioned should already be covered by an approved **TWAO** from Chiltern Rail for the Evergreen III project (now East West Rail). Property considerations to be developed include:*

1 *The **Co-op** nursery building in Roger Dudman Way,*

2 *The **YHA** building in Roger Dudman Way,*

3 *The railway personnel displaced from the existing platform 2 by the new island platform,*

4 *The existing **NR** Maintenance storage facility and Road Rail Access Point located adjacent to the West Midland Down Side sidings.*

5 *The following options are to be considered (See Appendix H plan).*

6 *The relocation of the nursery building onto the area of land adjacent to the Down Side North sidings.*

7 *The relocation of the nursery building onto the site of the existing Maintenance depot by the West Midland sidings.*

8 *Diversion of Roger Dudman Way onto the Cripley Road to release land for either, extending the **YHA** to the west or north, building of additional railway accommodation and provision of a west station access (dependant on further **YHA** consultation).*

9 *Relocation of the **YHA** and/or Nursery to 3rd Party land (**CPO** may be necessary)*

10 *The relocation of the existing Maintenance storage depot onto the area of land adjacent to the Down Side North sidings and the provision of a Road Rail Access Point.*

1.3 Oxford Corridor CP5 Configuration States

The key configuration states, service outputs and dates by which they must be achieved are outlined below:

- *Configuration State 1: August 2015 commencement of Oxford Parkway to London Marylebone service,*
- *Configuration State 2: March 2016 commencement of Oxford Station to London Marylebone services,*
- *Configuration State 3a: June 2016 commencement of electrified services to Oxford from the south for driver training and testing purposes,*
- *Configuration State 3b: December 2016 commencement of electrified passenger services between Oxford Station and London Paddington,*
- *Configuration State 4: December 2017 commencement of East West Rail Phase 2 services between London Paddington and Milton Keynes / Bedford via Oxford,*
- *Configuration State 5: May 2018 commencement of full **IEP** timetable.*

This report deals with the Engineering works required to support Configuration State 5.

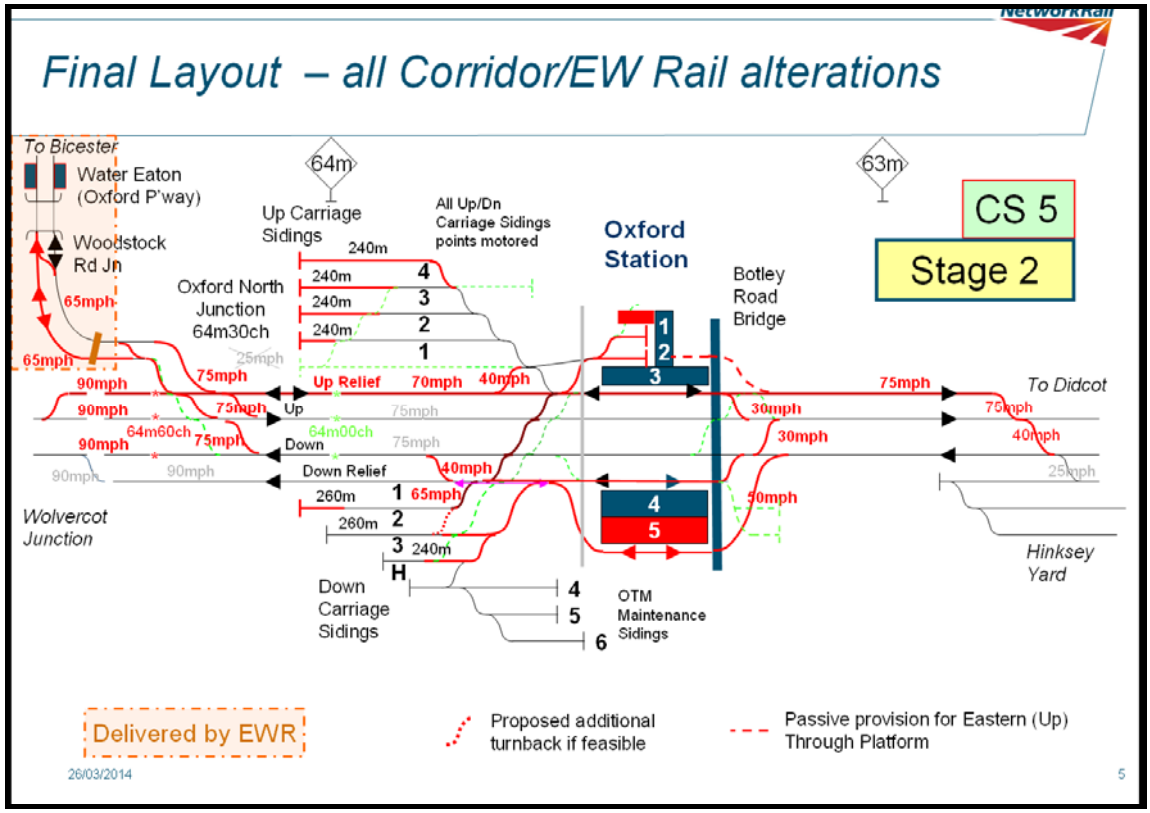

Figure 2 PRS Extract, proposed Oxford Corridor Layout Configuration State 5

2 Lineside Corridor Works

This chapter addresses the lineside works required in establishing a new Down through route for the Western side of the Oxford Corridor, local to the Station.

2.1 Track

2.1.1 Existing Conditions

The site is centred about Oxford Station on ELR DCL at 63m 41ch. The station is approached from the south on a three track alignment consisting of the Down Main, Up Main and Down/Up Loop. Just south of the station a 25mph facing turnout (237B Points) provides a connection from the Down Main to the Down Passenger Loop, widening the railway corridor to a four-track layout. This four-track layout continues through the remainder of the site.

A pair of 25mph crossovers between the Up Main and the Down/Up Loop are located just south of the station. The northernmost of the two crossovers (235A/B Points) is a facing crossover on the Up Main and provides access from the Up Main onto the Down/Up Loop. At this point the Down/Up Loop becomes the bi-directional Up Passenger Loop. The southernmost of the two crossovers (233A/B Points) provides a connection from the Up Passenger Loop back onto the Up Main.

A third 25mph crossover (238A/B Points) between the Down Main and the Up Main is located at the far south end of the platforms at Oxford Station. This crossover, in conjunction with 235A/B Points, provides access from the Down/Up Loop onto the Down Main.

There are three operational platforms at Oxford Station. Platform 1 is located on the Up Passenger Loop and has an operational length of 274m. Platform 2 is located on the Down Passenger Loop and has an operational length of 275m. Platform 3 is a terminal bay platform located on the Up side of the north end of the station. Platform 3 is not affected by this aspect of the scheme.

At the north end of Platform 2 a 25mph crossover (247A/B Points) is provided between the Down Passenger Loop and the Down Main. Beyond this is a ladder arrangement between the Up Passenger Loop and the Down Passenger Loop and S&C connections to the Up Sidings and Down Sidings.

The line speed on the Down Main and Up Main is 75mph, the line speed on the Down Passenger Loop and Down/Up Loop / Up Passenger Loop is 25mph within the limits of this study.

There are a number of structures within the limits of the study:

- River Isis Underbridge is located at the far south end of the site at 62m 79ch.
- Cemetery Road Footbridge is located approximately 230m south of the station at 63m 21ch.
- Botley Road underbridge is located immediately adjacent to the south end of Platforms 1 and 2. The track over this structure is of a direct fix form due to the limited headroom available for highway vehicles on Botley Road.
- Sheepwash River underbridge is located immediately adjacent to the north end of Platforms 1 and 2. There is a western side span adjacent to the Down Passenger Loop span which carries a road and footpath providing access along Roger Dudman Way.
- There is a station footbridge and lift.
- Records show a subway (currently out of use) located approximately 100m from the south end of the platforms.

2.1.2 Project Remit

There is an aspiration to provide an additional platform face (proposed Platform 5) on the Down side of the station to the rear of the existing Platform 2 (proposed Platform 4), thus creating a new island platform.

Connections to the Down Main at the south end and Down Passenger Loop at the north end are required to effectively create a new loop line on the western side of the station.

Both faces of the new island platform need to provide an operational length of 269m. This will allow both platforms to serve 260m long IEP trains with a further 9m allowance for splitting and joining.

Platform starter signals are required at the north end of the new island platform. These signals need to be positioned to provide 17m sighting distance for the worst case train stopping position. Platform starter signals are also required at the south end of the new island platform for turnback moves. These signals only require a sighting distance of 10m as they will be read from a stationary position.

In conjunction with the remodelling of the S&C layout to the south of the station, Botley Road underbridge is to be reconstructed. This work is being undertaken to allow the restricted headroom for highway traffic on Botley Road to be increased. This reconstruction provides an opportunity for the track layout, which is currently constrained by the direct fix track form over Botley Road, to be remodelled to suit the project requirements.

There are a number of interfaces with other aspects of the wider Oxford Corridor project which need to be considered. In particular, proposals for the new island platform and associated track alignments need to take account of the following activities:

- Down Passenger Loop to be upgraded to 40mph through the platform and 65mph further north and renamed Down Relief.
- Down/Up Loop / Up Passenger Loop to be upgraded to 75mph and renamed Up Relief.
- Bay platforms to be remodelled to accommodate longer trains.
- Platforms to be renumbered as follows:
  - Existing Parcel Platform → New Platform 1
  - Existing Platform 3 → New Platform 2
  - Existing Platform 1 → New Platform 3
  - Existing Platform 2 → New Platform 4
- Up Carriage Sidings, Down Carriage Sidings and entire layout, including ladder, to the north of Oxford Station to be remodelled.

2.1.3 Down Island Platform Option Overview

As shown on drawing B90505B-PWY-DRG3022 (see Appendix A). This option provides an island platform arrangement with the following speeds and standage:

- Down Main to Platform 5 (South Connection) – Turnout 91XJ, 50mph
- Platform 5 to Down Relief (North Connection) – Turnout 91XK, 50mph
- Platform 4 Usable Operational Length – 269m

2.1.3.1 Technical Considerations

A track alignment design has been developed which provides the operational capacity discussed above. Key aspects of the track alignment design are as follows:

- Desirable 40m separation between S&C units is not achieved due to space constraints.
- Desirable 40m constant horizontal geometry beyond S&C is not achieved due to space constraints.
- Preferred geometry (in accordance with section J.1.1 of NR/L2/TRK/2049) used for all S&C units except for south and north end turnouts to Platform 5. These are non-preferred.
- 269m operational platform length provided on Platforms 4 and 5.

The key technical issues associated with this option which will require consideration at the next GRIP stage are as follows:

- South of Cemetery Road underbridge the Down Main has been slued significantly towards the east (in excess of half a gauge in some areas). This has been necessary in order to accommodate the new turnout to the Platform 5 line. The alignment of the Platform 5 line passes close to the existing Cemetery boundary fence (approx 1.7m

minimum clearance). The alignment is also foul of the western abutment of Cemetery Road footbridge. The proposed track realignment has the following implications:

- An assessment will be required at AiP stage to determine the gauge clearances to the boundary fence in the vicinity of the new turnout 91XJ. Consideration will also have to be given to any requirements for OLE structures and lineside cable routes.
- Modifications will be required to the footbridge to allow the abutment to be relocated to achieve gauge clearance.
- The extent of realignment south of Cemetery Road footbridge is indicative only at this stage. It is not anticipated that any realignment will be necessary over the River Isis underbridge. This will be subject to confirmation at the next GRIP stage. If realignment is required a gauging assessment of the structure will be required.

- No ten-foot interval has been provided within the extended section of three track railway south of Botley Road underbridge. It is assumed that this will be acceptable as it replicates the existing arrangement through the station. However, a derogation will be required if this option is progressed at the next GRIP stage.
- It has been assumed that a ballasted bridge deck will be provided for the main lines spanning Botley Road, initial design work by the bridge engineer supports this assumption. However, in order to achieve the required headroom for highway vehicles, it is likely that the ballast depth will be restricted (150mm minimum, 200mm maximum). This will require a derogation against section 8.2 of NR/L2/TRK/2102.
- A high level assessment of the vertical track alignment through the station area has been undertaken using topographical survey data. This assessment suggests that it would be feasible to develop a vertical alignment compatible with the location of the proposed S&C units. The vertical track alignment can also be achived assuming the level differencial between the mains and loop alignments does not exceed 100mm.
- It is assumed that the track level adjacent to the new platform 5 will not exceed an average grade of 1 in 500.
- Reference to Network Rail records indicate that the proposed alignment falls outside the existing railway land boundary in the vicinity of the Youth Hostel and Sheepwash River underbridge. This will require further investigation at the next GRIP stage to clarify the need for any additional land and appropriate powers for the new railway alignment
- The north connection from Platform 5 onto the Down Relief will require the reconstruction of the western most span of Sheepwash River underbridge. Due to the requirement to achieve 9.6m clearance to boundary fence to the rear of the properties on Abbey Road and the angle of the turnout from the Down Relief, minimal clearance is provided to the existing western girder of the Down Relief span. This arrangement may require modifications to be made to the girder to achieve gauge clearance and to allow the reconstruction of the adjacent western span. If modifications are required to the girder it will be necessary to temporarily remove the Down Relief track over Sheepwash River whilst bridge works are carried out (see Section 4.1).

2.2 OLE

The proposed platform 5 will be electrified at 25kV. The OLE design will interface with the Phase 1 (GWEP) OLE design north and south of the station. The platform 5 OLE design will need to be incorporated into the OLE design works for the main lines through the station; this is particularly relevant at the turn outs at Cemetery Footbridge and Sheepwash Bridge.

The OLE past the proposed platform will be supported from single track cantilevers in the cess opposite the platform. The foundations for the OLE structures will be integrated into the proposed retaining wall where required. A mid point anchor may be required adjacent to the platform, if this is the case then the anchor will be the SIC type mid point anchor as detailed on *Series 1 drawing B.05.02*.

A contact wire height wire height past the platform such that live parts are kept further than 3.5m away from the standing surface in accordance with the provisions of BS EN 50122-1:2011 is achievable.

At Sheepwash Bridge the roadway will be close to the electrified rail bridge. There are no standards governing the lateral clearances from road vehicle to live parts, however all live parts will be further than 2.25m as specified for standing surfaces in BS EN 50122-1:2011. This will be covered further in the AiP submission.

2.3 E&P

From the plant perspective the introduction of the loop to serve the additional platform and the relocation of the crossover between the Down Oxford Relief and Down Oxford Main from its existing position immediately north of Oxford Station to a location some 600m further north will have very little impact.

The location of any new equipment required to be operational after the Phase 2 works have been completed, has been positioned where the new alignment can be installed without the need to relocate equipment. However some re-routing and alteration of the on-track cable routes may be required to allow the construction of the new formation.

2.3.1 Points Heating

As part of the Phase 1 works all the motor operated points north of the station are to be fitted with new electric points heating complying with current Network Rail Standards and Specifications. The existing crossover, current 247A/B points (to be renumbered as 9139A/B points as part of the Phase 1 works) will be retained however new points heating equipment will be provided as the existing arrangements are considered to be life expired.

The Phase 1 design has considered the requirements for the additional and relocated points as an integral part of the design. Phase 2 will require the equipment associated with the crossover to be removed and new equipment provided to serve the connection from the new platform 5 and relocated crossover to be installed and served from points heating control cubicles already provided.

To form a connection to the new platform line at the south end of the station a new turnout off the Down Oxford Main will be required. Once again an allowance has been made within the Phase 1 design for the additional turnout. Phase 2 will require the equipment associated with the connection from the new Platform 5 be installed and served from points heating control cubicles already provided.

2.3.2 Signalling Power Supplies

As part of the Phase 1 works a new class II based 650V signalling power supply system will be provided throughout the Oxford Corridor. As part of the electrical design an allowance has been made to cater for the additional and relocated signals and points.

Depending upon the signalling design new location case suites may be provided at either the north, or south of the station, or possibly both ends. Sufficient spare capacity has been incorporated within the Phase 1 design to permit the installation, if any of additional functional supply points which may be required.

Some alteration of the 650V feeder cables will be required to facilitate the installation of any additional function supply points associated with the Phase 2 works.

2.4 Telecomms

Operational telecoms assets shall be altered in line with the signalling requirements (currently shown on the Phase 2 Signalling Sketch). This shall include;

- Signal Post Telephones (SPT)
- Lineside Telephones
- Public Telephones (at Level Crossings)

Additionally, operational telecoms assets shall be altered in line with the proposed PWay remodelling. This shall include;

- Surface Concrete Troughing
- Operational telecoms cabling

Changes shall be required on the Oxford Corridor Telephone Concentrator (Aastra MX One) at the Thames Valley Signalling Control Centre to reflect the changes to lineside telephony.

It is not envisaged changes will be required to the GSM-R, however PAN 61 will be followed to update the GSM-R system with any changes to Signalling TD arrangements.

2.5 Infrastructure

Drawing B90505B-DRG-PWY3022 shows the new platform five track turning out from the Down Main approximately 300m south of the station. The railway corridor in this area appears wide enough to allow a continuous safe walkway along down cess. Cemetery footbridge, 200m south of the station, will be reconstructed to allow gauge clearance for the new track and maintaining this continuous walkway should be considered in its design. The new span of Botley Road bridge, immediately south of the station, should preferably be designed to maintain continuity of this safe walkway however it may be more practical to provide a discrete position of safety at each end of the span and appropriate warning signage.

Access steps at the south end of new platforms four and five are shown in the previous GRIP stage design, see Figure 3. These will be required to maintain the southbound exit signals but we do not propose that they are used for access along the tracks. To serve this purpose a lineside access gate should be provided at the south west corner of the bridge span, near to the existing abnormal loads crossing.

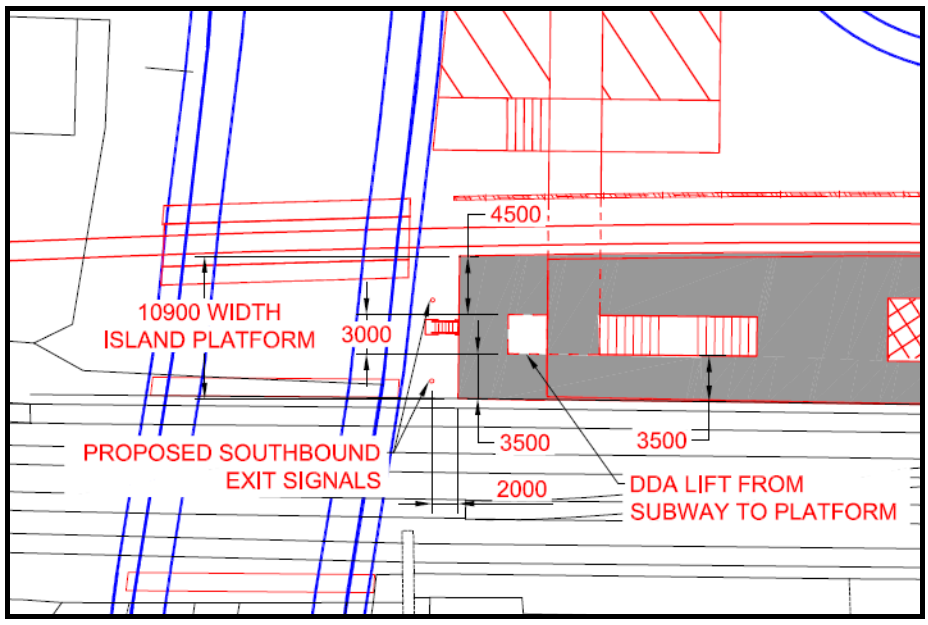

Figure 3 Lineside access, South end of new island platform

Through the station, access will be possible along the new western cess line. The cess is above surrounding ground level in this area so a retaining wall will be required. This should be provided with a safety fence to protect lineside staff, who will be working at height.

Overhead line equipment masts will be located between the retaining wall and the tracks. These should be designed to facilitate the provision of a cess walkway, as described in the track design handbook section A8.1a.

At the north end of the platform the new and existing tracks converge on Sheepwash bridge, Figure 4. End of platform steps will be required to serve the northbound departure signals but we do not propose that these are used to access the lineside environment due to the limited clearances across the bridge. Patrolling staff would be expected to use either the new driver walkway across the east side of the bridge or the new road bridge being installed across Sheepwash cut.

The Drivers current walking route to the down sidings is off the end of platform 2, and out of a key-coded gate into Roger Dudman Way. This will be curtailed by the new platform 5 track. If separation from passenger routes is to be maintained, consideration should be given to extending the existing footbridge by another span into the realigned access road to the sidings. The additional bridge span could then also be used for emergency evacuation purposes.

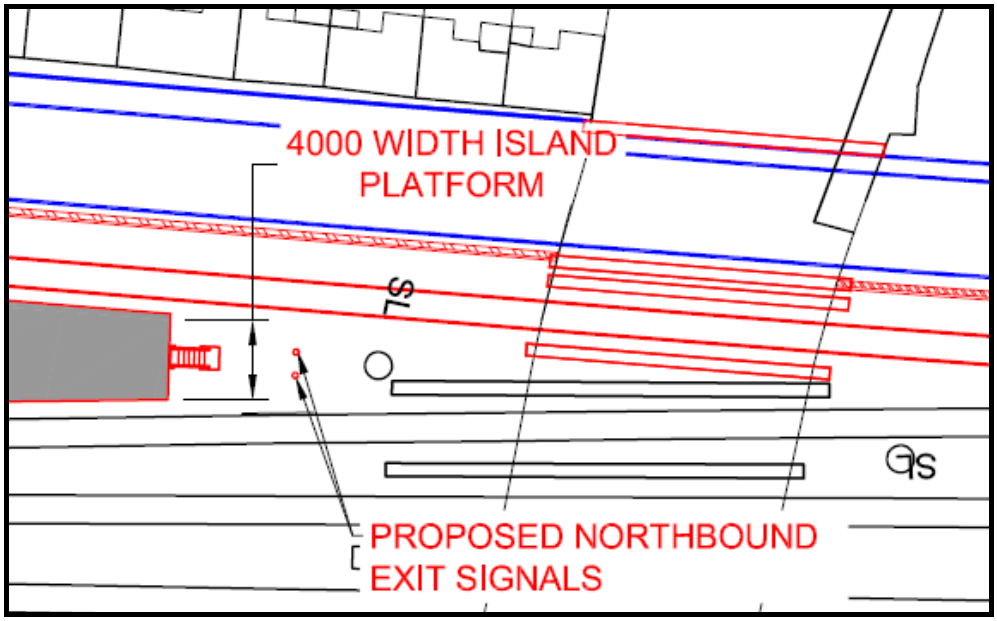

Figure 4 Lineside access, North end of new island platform

3 Botley Road Rail and Highway Works

As part of works within the Oxford Corridor a major reconstruction of Botley Road is proposed. This proposal would involve significant widening the existing structure to provide an additional lane of traffic and a second pedestrian route. This bridge is one of the only routes that crosses the railway in Oxford and as such there is a desire to increase the headroom as well as providing additional lanes of traffic. There is also a requirement to provide ballasted track rather than the current direct fastened permanent way.

3.1 Bridges

3.1.1 Existing Structure

Botley Road bridge carries four tracks of the Didcot-Chester line over Botley Road. It provides one of the few locations where the road across Oxford can cross the railway, although there is alternate pedestrian access available in either direction via Cemetery Road Footbridge or via Sheepwash canal underbridge. The bridge was constructed prior to 1876, and the method of construction is unclear (no available records). However based upon experience it was expected that traditional open cut earthworks were used. This method would have had challenges due to high water table and flows.

Botley Road currently provides two lanes of road traffic through the main span and a single footpath running in an adjacent arch subway on the London side, located at a higher level. Current clearance to the underside of the bridge is 4.28m, signed at 13’ 6” (4.11m). There are bridge protection beams located on both approaches. There is an under-road inverted arch which spans between the main North and South abutment.

The Down Platform loop is carried on a modified Network Rail standard Z type deck, most details remain as per the current suite of standard drawings other than that the track is directly fastened to the cross girders using ASP type base plates.

The Up Main, Down Main and Up Platform loop lines are carried on a Joist in Concrete deck with the track directly fastened using ASP type base plates.

The construction depth between rail head and bridge soffit is currently a minimum of 545mm for the Down Platform Loop and 685mm for the other three lines.

Beneath the road surface, the bridge abutments are propped by an inverted arch. There is a pumped drainage system in place to remove the surface water from the dip in the road and prevent flooding.

There is an adjacent steel footbridge linking the station with its long stay car park. Records suggest there is a large (24") diameter water main located beneath the current emergency level crossing at the London end of the bridge.

The North abutment is currently formed of an original voided brick abutment of approximately 1400mm wide with occasional voids of approximately 300mm supported on shallow foundations combined with a series of 600mm diameter piles installed directly behind the brick abutment. The piles are connected to the brick abutment via a reinforced concrete cill unit which spans the two structures. The existing deck is supported on this cill unit with the load shared between the two foundations.

3.1.2 Project Remit

Oxford City Council and Oxfordshire County Council would like to increase to three traffic lanes, a pedestrian footpath and a cycle path to both sides of the road. This gives a total required clear span in the region of 19.2m. In addition they would like an increase in vertical clearance from road level to allow more economic acquisition of double deck buses. The absolute minimum clearance required is 4.80m plus an allowance for the sag in the road alignment of up to 80mm. This equates to an increase in clearance of 700mm on signed clearance. Network Rail have an aspiration to introduce ballasted track over the bridge, which increases the overall construction depth and adds to the required track lift or road lower. Botley Road will require a lower in the order of 1.50m. The existing inverted arch is also to be removed. These works will require specialist geotechnical input as they involve construction below the water table.

3.1.2.1 Constraints

There are a number of constraints on the existing bridge that need to be considered for the construction options. These break down into two main categories, permanent constraints and construction constraints.

Permanent Constraints

- Oxford Station to the North
- A number of existing and proposed S&C units to the South
- Vertical Alignment of Road under the bridge
- Adjacent junctions to the East and West
- Water table in the area which is above the existing foundations
- Ground conditions both within embankments and main strata
- Proposed installation of OLE over existing Railway before bridge is built.

Construction Constraints:

- Length of closures on Road and Railway
- Temporary diversion of pedestrian and vehicle traffic during works

- Emergency access by Fire, Police and Ambulance services during works

It is currently proposed to undertake the construction works during Phase 2. This will add additional complexity into the constructability design as the Great Western Electrification Programme (GWEP) is due to electrify the route from Reading to Oxford in Phase 1. This means that the reconstruction of the bridge will take place once OLE has been installed.

3.1.2.2 Technical Considerations

The design of the bridge is governed by Network Rail Standard NR/L3/CIV/020; Design of Bridges and Railway Group Standard GC/RT5212 for gauge clearance to rail vehicles.

NR/L3/CIV/020 provides general guidance on the design of bridges and sets a deflection limit for the safe operation of rail traffic at span/600, which is the governing criterion in this instance due to the requirement to minimise construction depth.

GC/RT5212 does not allow any elements of bridge structure to protrude above rail level outside of platform gauge.

The design of the bridge will be undertaken to applicable Eurocodes and design decisions recorded in F1990 – 1999 as appropriate.

DMRB documents such as BD 60 02 – “The Design of Highway Bridges for Vehicle Collision Loads” will also be consulted in the design of the structure.

3.1.3 Existing Ground Conditions

As part of the GRIP3 AIP works, a Geotechnical and Geo-Environmental ground investigation was carried out to assess ground, groundwater and contamination conditions present with the Oxford Capacity area. Included within this was a targeted investigation around Botely Road Bridge to provide an initial assessment for the construction feasibility assessment. The ground investigation information, including a high level review of the Botely Road geotechnical constraints is captured with TSP report W1002B-TTS-REP-EGE-007002 version A01 dated September 2014. The geo-environmental risks are discussed in detail as part of the contaminated land assessment report, TSP document W1002B-TTS-REP-EGE-007001 A01 (yet to be issued). The following captures the key findings associated with the Botely Road Bridge (based on boreholes BH01 and BH06): A summary of the ground conditions present at Botley Road Bridge is presented below in Table 1.

Strata	**Top of Strata (m AOD)**		**Depth to base (m AOD)**	
	Upper Limit	**Lower Limit**	**Upper Limit**	**Lower Limit**
Botley Road Bridge Ground Model				
Made Ground	Ground Level		56.21	58.15
Alluvium	58.15	56.21	55.11	55.51

Strata	Top of Strata (m AOD)		Depth to base (m AOD)	
	Upper Limit	Lower Limit	Upper Limit	Lower Limit
River Terrace Deposits	56.41	55.11	52.91	49.61
Oxford Clay	52.91	49.61	Base not proven	
Groundwater	55.5m AOD (discussed in detail below)			

Table 1 Ground model specific to Botley Road Bridge.

The groundwater conditions encountered are as detailed:

- Borehole log data indicates groundwater strikes associated with the River Terrace Deposits are in the range 56.12mAOD and 56.73mAOD.
- Borehole monitoring data from River Terrace Deposits piezometers indicates a water level of 55.3mAOD to 55.6 m AOD. During the period of monitoring the groundwater levels in the piezometers remained relatively stable, typically varying by no more than a few hundred millimetres during the period of monitoring.
- A series of cores were drilled into the structure in July 2014 (TSP Bridges feasibility report [28]). Flowing water was recorded within two of the cores. Core 3497/C6 in the North Abutment reported water overflowing at 55.23 m AOD and Core 3497/C12 in the South Abutment reported water overflowing at 54.17 m AOD.
- Based on the available piezometer monitoring data, the groundwater levels in the River Terrace Deposits in the vicinity of the Bridge were approximately 55.5mAOD (this is consistent with the original anecdotal information that groundwater levels were approximately at road level). However, the data from the borehole logs indicated groundwater levels that were significantly higher, up to 56.7mAOD. It should be noted that groundwater level data was only available from a relatively short period (around six weeks during July/August 2014). Longer term monitoring of groundwater levels would be needed to identify seasonal variations, and particularly to identify any changes in groundwater level resulting from storm rainfall events, especially considering the regional study data presented in Figure 9.

It can be inferred that the existing northern abutment and the new southern abutment will be founded within the River Terrace Deposits. The proposed vertical and horizontal alignments for the proposed road lower will be below the groundwater table and into the River Terrace Deposits.

3.1.4 Geotechnical Constraints

There are a number of geotechnical constraints that need to be considered for the construction options:

Groundwater:

- From the ground information reviewed and completed by TSP, the current road level is below the water table (sits with the River Terrace Deposits).

- Although not proven by TSP, we would expect the inverted arch to have been constructed on a layer of non engineered clay to reduce temporary water inflow (during construction), this will not be the case where road widening beyond the current bridge footprint is required.
- The River Terrace Deposits are considered highly Permeable
- Therefore groundwater control will be required for the proposed road widening and lowering

Geotechnical:

- The proven ground conditions suggests that sidewall collapse of any temporary excavation is possible in the temporary works condition
- Possible obstructions within the Made Ground and the natural ground (River Terrace Gravels) is expected and will need to be accounted for within any pile or embedded retaining wall designs.
- Uplift of the ground slabs and reinforced concrete boxes due to groundwater pressures could impact in the permanent conditions.

Geo-Environmental:

- The Made Ground around Botely Road has been proven to be impacted by hydrocarbon contamination. This could impact on the disposal routes, and costs, for removing any soil arisings as part of the scheme, and also pose a human health risk.
- The groundwater to the north and the south are shown to be contaminated by hydrocarbon contamination. Although not recorded at the bridge location, the presence of hydrocarbon contamination once the construction period is reached cannot be discounted. Control, storage and disposal of the contaminated groundwater will need to be considered.

3.1.5 Outcomes from Previous Feasibility Report

Previous GRIP 2 work reviewed a number of construction types, these will not be discussed in detail here and reference should be made to the previous report for full details. The construction types previously proposed were:

- Network Rail Standard U Deck
- Network Rail Standard D / E Deck
- Direct Fastened Joist in Concrete Deck
- Orthotropic Steel Deck

The preferred construction type was a single 19m span Orthotropic Steel Deck. A sub-option considered the creation of a three span portalised structure but was unable to provide sufficient guidance on how this could be achieved without significantly disrupting rail and road traffic.

3.1.5.1 Constructability Review

A constructability review of the previous options has been undertaken. This review found that the Orthotropic Steel deck type was still preferred, however the review found that a three span structure could be possible as well as a single span structure.

The three options proposed are:

3.1.5.1.1 Single 19m Orthotropic Steel Deck

This solution would see the use of a single orthotropic steel deck spanning between a new sheet pile South abutment and reusing a strengthened North abutment. This solution would require a construction depth of approximately 1230mm from top of rail to bridge soffit.

3.1.5.1.2 10m Orthotropic Steel Deck with RC Walkways

This solution is achieved by installing precast Reinforced Concrete (RC) walkways of approximately 4.5m internal width either side of the proposed road and spanning a 10m orthotropic steel deck between them. This solution does not reuse existing abutments. This solution would require a construction depth of approximately 980mm from top of rail to bridge soffit.

3.1.5.1.3 Three Span Orthotropic Steel Deck

This solution would be achieved by installing two new piers formed from combi-pile walls between the proposed footpaths and the roadway with a new sheet pile South abutment. The orthotropic steel deck would be installed as continuous over the piers and integral with the South abutment via a site welded connection. This solution would require a construction depth of approximately 1030mm from top of rail to bridge soffit.

3.1.6 Construction Sequence

As part of the constructability review of each solution an outline sequence was determined, this ensures that the solutions are practically buildable given the sensitive nature of Botley Road whilst minimising the impact on the operation of the railway. A brief description of the sequence for each solution is described below.

The staging covers the requirements for installing the main span which carries the Up and Down Main and Loop lines as this is seen as the most difficult to stage. Additional works will be required to install the Down Island Platform line and to provide supports for the aspirational Up Island Platform line. These are not described in the sequencing as these are not being installed under operational lines and are therefore simpler to undertake with a number of potential staging options.

Details of possession strategies for each of the options can be found at the end of this section.

3.1.6.1 Option 1 – Single 19m Span Steel Orthotropic Deck

3.1.6.1.1 Stage 1 – Services diversion

Existing record information shows a large number of services within the existing road, separated footpath through the arch span and underneath the existing level crossing (Figure 5). All of these services will clash with the proposed structure and preparatory works.

It is proposed to divert these services into a micro tunnel to the South of Botley Road from the junction of Becket Street and Park End Street, underneath the station car park to the junction of Mill Street and Botley Road (Figure 6).

These works could take place during local diversions of traffic and should be able to progress without disruptive possessions of the railway. The tunnel may have to be stopped short of the existing sewer and the cables threaded through the sewer to the final tie in.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.1.

3.1.6.1.2 Stage 2 – Grouting Works

In preparation for the excavation of material currently below the water table, a water exclusion zone is to be created around the structure and approaches. The outline proposal for this is to install a grout curtain between existing ground level and the oxford clays below. A watering monitoring regime would be required prior to and after the grouting works to assess the efficiency of the grouting.

Grouting works could take place from the road way during night time single lane working. Where grout is required underneath operational tracks this could be undertaken from the adjacent car parks.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.2.

3.1.6.1.3 Stage 3 – North Abutment Stabilisation

A full assessment will be required of the suitability of the existing North abutment to act as the permanent North abutment for the increased span. This is likely to show that additional strengthening or underpinning of the abutment is required.

These works could be undertaken during night time, single lane working at road level. It is likely this work could be undertaken without a disruptive possession of the railway.

3.1.6.1.4 Stage 4 – South Abutment Installation

The new South abutment would be installed using sheet piling installed from track level. This would need to take place during a disruptive possession. A piling rig would be located at track level and the piles installed to below track level – either by cutting down the piles after installation or providing a lower piling platform than existing track level. (Figure 7)

The sheet piling could also be undertaken to either side of the railway to provide the new permanent retaining wall adjacent to the proposed footpath. The sheet piles can later be faced with brick/block work to provide a decorative face for the new structure.

If a reinforced concrete bearing shelf was preferred this would also have to be installed prior to the main installation works to allow the concrete to cure. If it was acceptable to weld the deck

directly to the sheet piles during the main possession this additional bearing shelf would not be required.

The works within the railway corridor would require a disruptive possession.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.3.

3.1.6.1.5 Stage 5 – Moving adjacent footbridge

The existing pedestrian footbridge from the station to the station car park is currently of insufficient span for the proposed road. The position of the existing structure is also a clash with the potential Up Island platform track. The footbridge will be located to the East of its existing location to avoid the potential clash with the proposed track and extended to land beyond the proposed road width (Figure 8).

These works can be undertaken without a disruptive railway possession but would likely cause disruption to road users. The existing bridge could be retained in position during the erection of the proposed structure and potentially removed immediately after the erection of the proposed structure.

3.1.6.1.6 Stage 6 – Demolition of existing structure

Demolition of the existing structure is classed as the following activities:

- Removal of existing bridge decks
- Demolition of existing South abutments
- Lowering of existing road level
- Removal of all material North of the South pile wall

The demolition stage should remove as much material as possible to reduce the subsequent impact on road users during completion stages.

Providing a longer single ballasted span in place of the existing single direct fastened span will lead to an increase in construction depth. As the track level must be maintained due to the adjacent platform this means that the existing road level much be lowered prior to installation of the proposed deck to ensure that the existing 4.2m clearance is maintained.

These works would require a disruptive possession of the railway and closure of the road.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.4.

3.1.6.1.7 Stage 7 – Installation of proposed structure

The installation of the proposed structure is classed as the following activities:

- Installation of North Cill unit and ballast retaining wall
- Installation of South ballast retaining wall
- Installation of proposed main deck spans

The existing cill unit on the North Abutment would need to be broken down to allow the proposed pre-cast concrete cill unit to be installed. The existing cill unit consists of a precast pilecap which is connected to the piles via post-tensioned Macalloy bars (record drawing

C.31677) and that sits on a rubber bearing onto the existing abutment. A ballast retaining wall will also be required – this could be incorporated into the new cill unit or installed separately.

Once both cills are in place the main deck can be installed. Due to the 14m width of the main deck it is likely that the deck will have to be transported to the site in 4 segments and welded together on site. Each 4m segment would weigh approximately 50T, be 3.5m wide and 19m long. The complete main deck would then be installed.

Once the new railway deck is in place ballast and track would be installed and the OLE would be re-wired and energised.

These works would require a disruptive possession of the railway and closure of the road.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.7.

3.1.6.1.8 Stage 8 – Construction of under road slab and road surfacing

For the permanent exclusion of water and foundation under the road it is proposed to put a permanent concrete under road slab in place. This will form the permanent foundation for the structure. Temporary pumping of the road will be required as at this stage the existing sump will no longer be functional.

The type of connection between the under-road slab and the bedrock (Oxford Clay) needs to be considered for the long term effects of the high water table.

This stage would see the use of temporary traffic management along with temporary retaining walls (as necessary) to allow construction of the South half of the road and then the North half of the road in stages.

Once the under-road slab and control for permanent ground water have been completed the surface water pumping system will need to be updated prior to the road surfacing being installed.

These works would not require a disruptive possession of the railway but would require staging works which would reduce the useable road width to a single lane and occasionally require full road closures. It is likely that an overnight closure of the road will be required to complete the work and tie the road surface together.

3.1.6.2 Option 2 – 10m Orthotropic Steel Deck with RC Walkways

3.1.6.2.1 Stage 1 – Services diversion

Existing record information shows a large number of services within the existing road, separated footpath through the arch span and underneath the existing level crossing (Figure 5). All of these services will clash with the proposed structure and preparatory works.

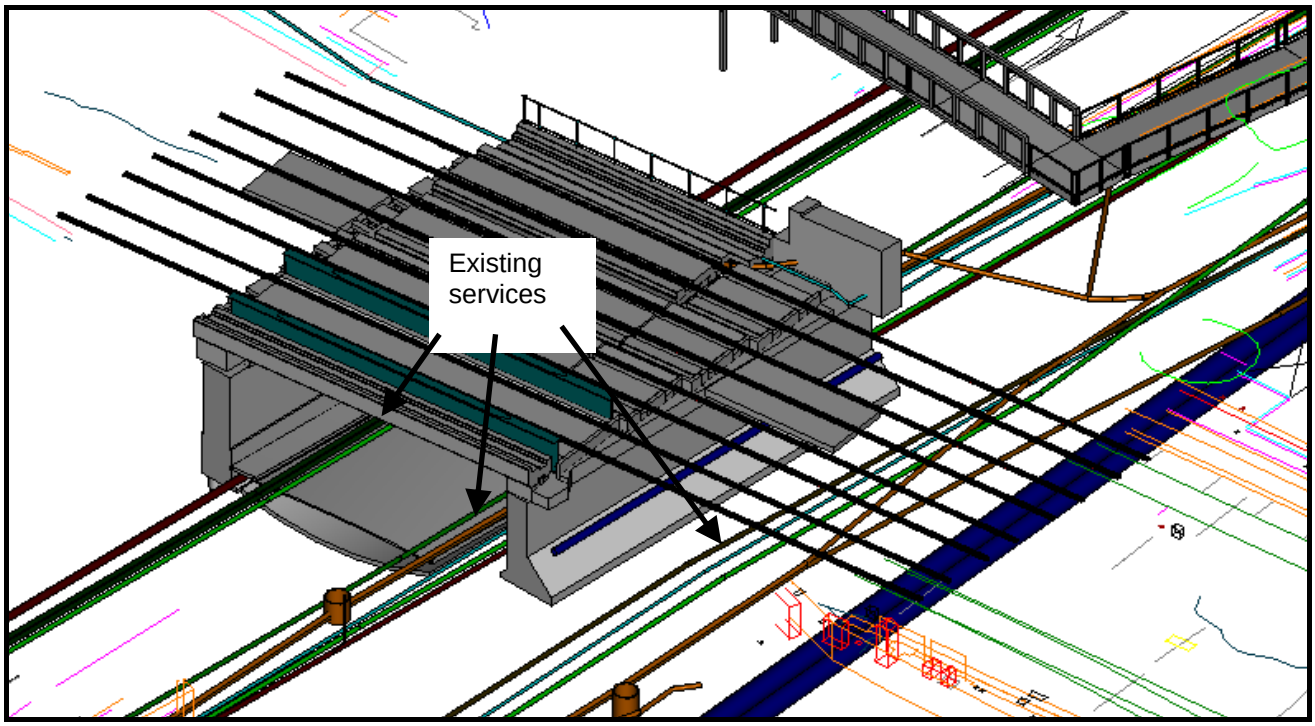

Figure 5 3D model extract showing number of existing services around Botley Road

It is proposed to divert these services into a micro tunnel to the South of Botley Road from the junction of Becket Street and Park End Street, underneath the station car park to the junction of Mill Street and Botley Road (Figure 6).

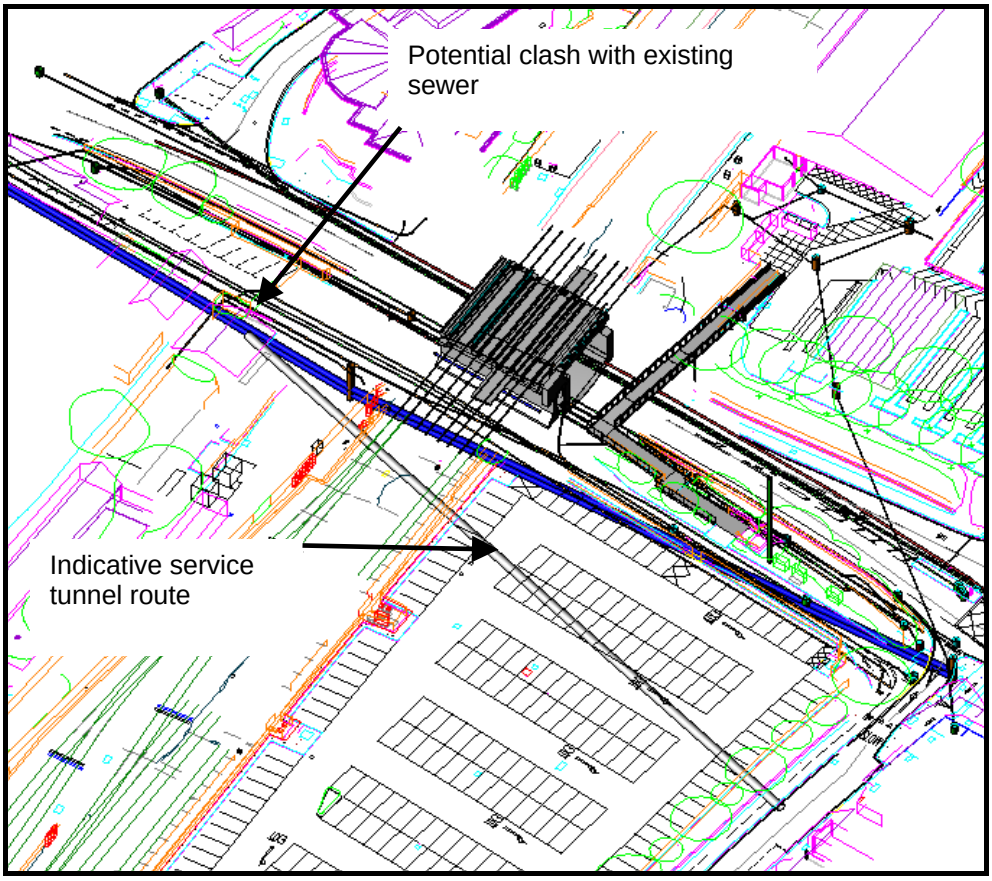

Figure 6 3D model extract at Botley Road, showing indicative service tunnel route

These works could take place during local diversions of traffic and should be able to progress without disruptive possessions of the railway. The tunnel may have to be stopped short of the existing sewer and the cables threaded through the sewer to the final tie in.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.1.

3.1.6.2.2 Stage 2 – Grouting Works

In preparation for the excavation of material currently below the water table, a water exclusion zone is to be created around the structure and approaches. The outline proposal for this is to install a grout curtain between existing ground level and the oxford clays below. A watering monitoring regime would be required prior to and after the grouting works to assess the efficiency of the grouting.

Grouting works could take place from the road way during night time single lane working. Where grout is required underneath operational tracks this could be undertaken from the adjacent car parks.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.2.

3.1.6.2.3 Stage 3 – North Abutment Stabilisation

An assessment will be required of the stability of the existing North abutment throughout the construction works to ensure that the foundation is not undermined by any stage – such as the removal of the inverted arch prior to the base slab being completed. This may show that additional strengthening or underpinning of the abutment is required to prevent collapse of the existing abutment during the works.

These works could be undertaken during night time, single lane working at road level. It is likely this work could be undertaken without a disruptive possession of the railway.

3.1.6.2.4 Stage 4 – South Ground Stabilisation

Excavation will be required behind the Existing South Arch Abutment to allow for installation of the South RC Walkway. This would conservatively take the form of a row of sheet piles the length of the excavation (Figure 7). Sheet piles should be installed parallel to the operational railway to prevent collapse during these excavations.

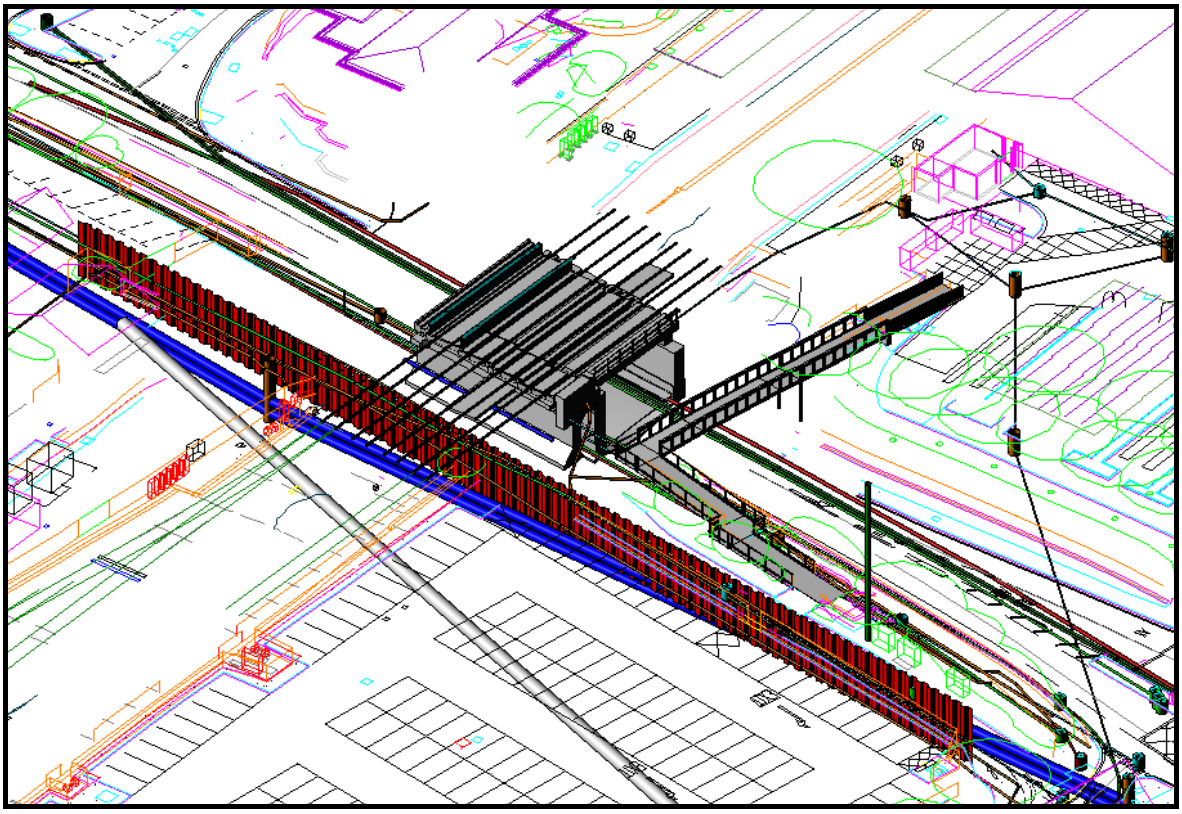

Figure 7 3D model extract at Botley Road, installation of Sheet Piles to South

The sheet piles installed within the footprint of the existing railway will require a disruptive possession to take place. These do not need to be installed at the same time as the sheet piles outside of the railway footprint. The proposed sheet pile locations will cut through the existing line of a large diameter sewer – the service will have been diverted into the new service tunnel but the existing pipe will cause an obstruction.

3.1.6.2.5 Stage 5 – Moving Adjacent Footbridge

The existing pedestrian footbridge from the station to the station car park is currently of insufficient span for the proposed road. The position of the existing structure is also a clash with the potential Up Island platform tracks. The footbridge will be located to the East of its existing location to avoid the potential clash with the proposed tracks and extended to land beyond the proposed road width (Figure 8).

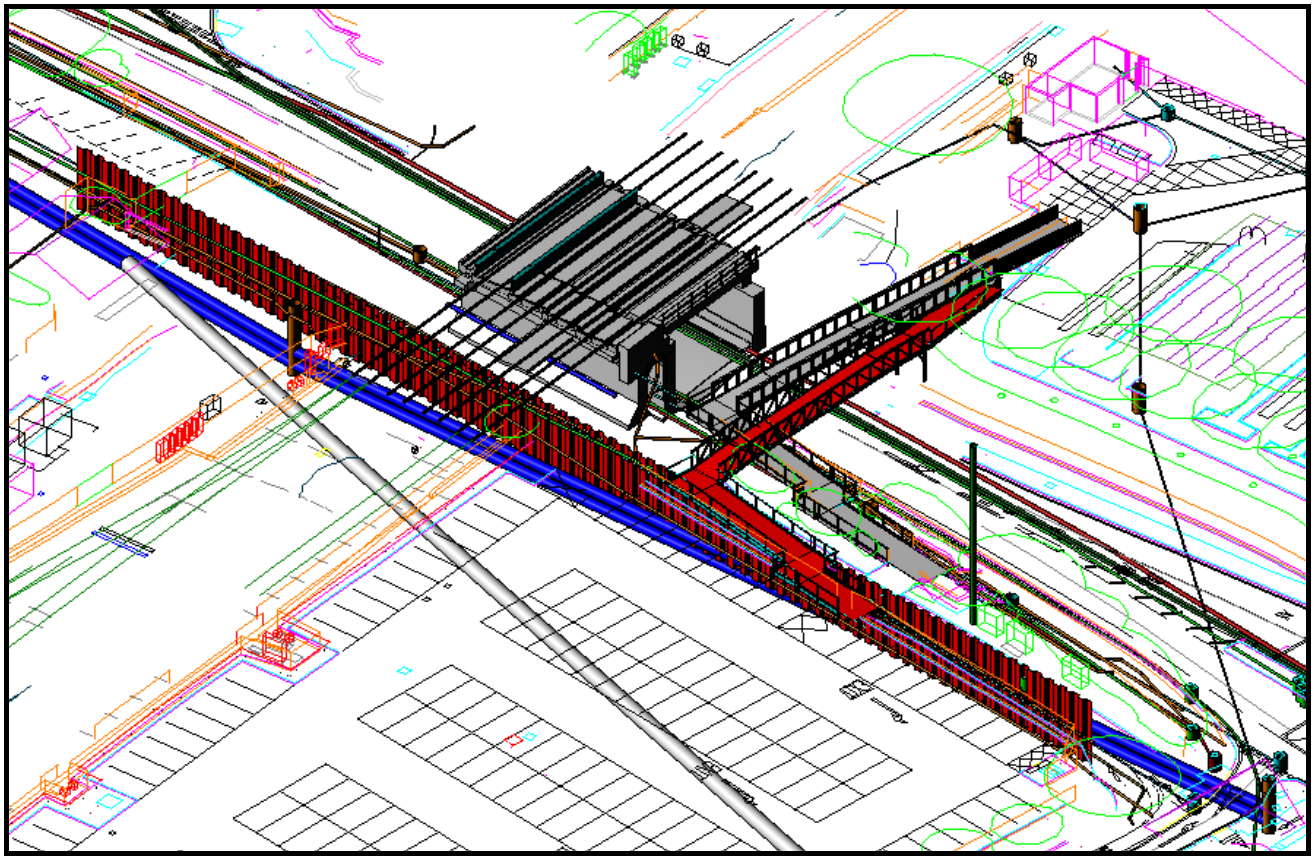

Figure 8 3D model extract at Botley Road, showing Proposed Footbridge (red) compared with existing (grey)

These works can be undertaken without a disruptive railway possession but would likely cause disruption to road users. The existing bridge could be retained in position during the erection of the proposed structure and potentially removed immediately after the erection of the proposed structure.

3.1.6.2.6 Stage 6 –Slide Track Preparation

To prepare for installation of the Reinforced Concrete (RC) Walkways a jacking slabs and anchor blocks will be installed on the East side of the railway adjacent to the existing structure. This will allow the RC Walkway to be slid into its final position during the installation stage. Installation of the jacking slab will require additional excavation and the stability of the adjacent road will need to be considered. Installation of the North jacking slab would require closure of the existing north pavement and carriageway line meaning only a single lane of traffic was

available until the main possession. Given the curing time of concrete and preparation time required for excavations this would likely be a minimum of four weeks prior to the installation date.

These works could be undertaken without a disruptive rail possession but will require single lane working and potentially temporary support to the existing road.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.5.

3.1.6.2.7 Stage 7 – Demolition of Existing Structure

Demolition of the existing structure is classed as the following activities:

- Removal of existing bridge decks
- Installation of piles within railway footprint (if not undertaken in Stage 5)
- Removal of all remaining material North of the South pile wall
- Removal of piles parallel to railway (from Stage 5)
- Demolition of existing South abutments
- Lowering of existing road level

The demolition stage should remove as much material as possible to reduce the subsequent impact of road users during completion stages.

Providing a single ballasted span in place of the existing single direct fastened span will lead to an increase in construction depth. As the track level must be maintained due to the adjacent platform this means that the existing road level much be lowered prior to installation of the proposed deck to ensure that the existing 4.2m clearance is maintained.

These works would require a disruptive possession of the railway and closure of the road.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.4.

3.1.6.2.8 Stage 8 – Installation of Proposed Structure

The installation of the proposed structure is classed as the following activities:

- Installation of sheet piles between RC Walkway and Proposed Road
- Installation of RC Walkways under main span
- Installation of proposed main deck span

Installing sheet piles between the RC walkways and the proposed road provides a cofferdam which will aid the construction and installation of the under road slab and means that excavation of the road down to the final level can then take place. Each sheet pile would also act as a guide wall for its adjacent RC walkway if required.

The RC walkways will initially be installed as ground bearing only. Current ground investigation indicates that the foundations will be within the River terrace deposits; however this needs to be confirmed by local boreholes and investigations as local structural cores show the presence of clay behind the abutments which is not consistent with the existing ground model.

Once both RC walkways are in place the main deck can be installed. Due to the 14m width of the main deck it is likely that the deck will have to be transported to the site in 4 segments and

welded together on site. Each 4m segment would weigh approximately 25T, be 3.5m wide and 10m long. The complete main deck would then be installed (Figure 9).

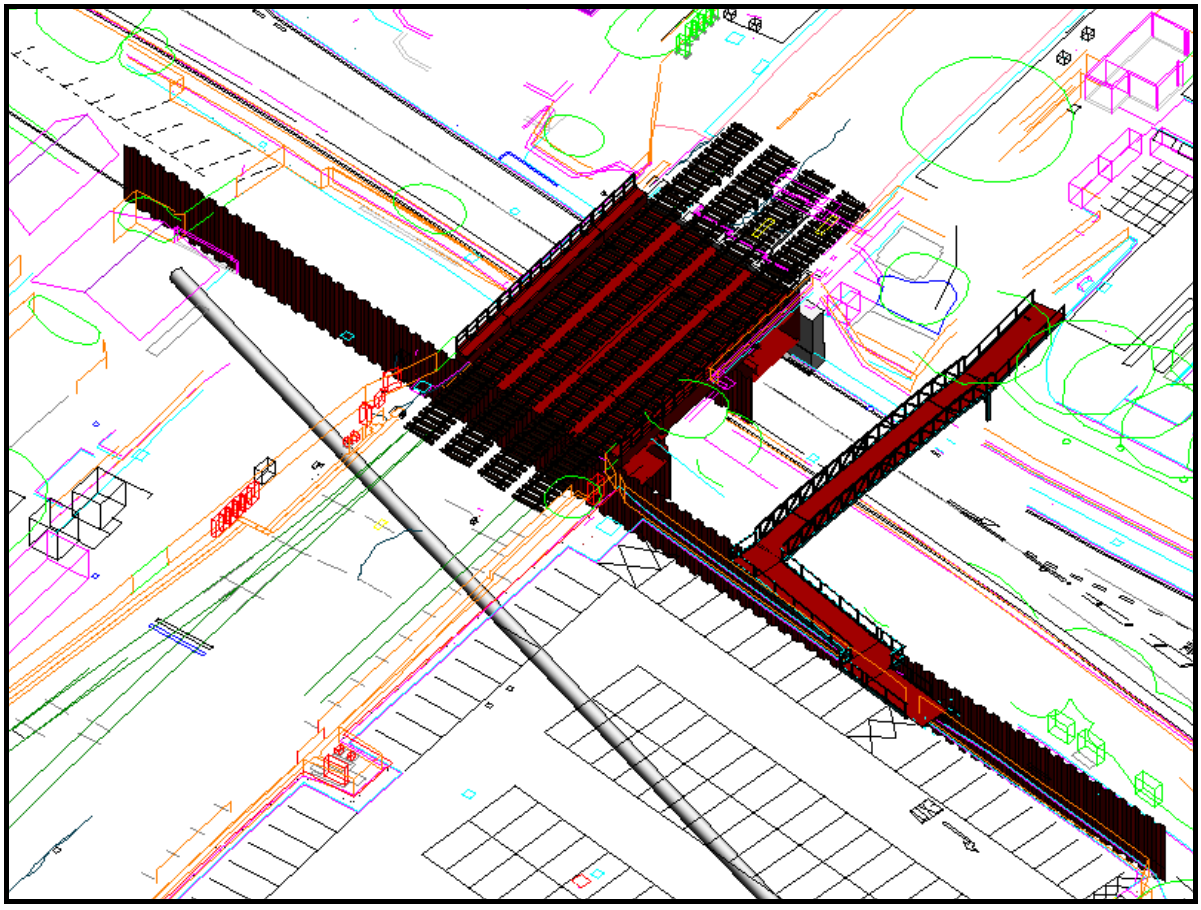

Figure 9 3D model extract at Botley Road, Proposed Main Span Installed

Once the new railway deck is in place ballast and track would be installed and the OLE would be re-wired and energised.

These works would require a disruptive possession of the railway and closure of the road.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.6 and 3.1.8.7.

3.1.6.2.9 Stage 9 – Installation of substructures

To provide the permanent foundations for the structure piling will be required from inside each of the RC walkways to resist the permanent uplift forces. This work could take place within the boxes with reduced height piling rigs. Due to the presence of obstructions (i.e. existing foundations) it is likely that a Pali Radice type method will be required which will penetrate any obstructions. Alternative piling solutions can be explored as design progresses.

To tie the RC walkways into the central under road slab a cast-in situ concrete upstand will be required to cover the sheet piles adjacent to the proposed road surface. This can be achieved

by friction welding studs onto the sheet piles and using reinforcement couplers cast into the RC walkway to tie the two structures together.

The main under road slab could be installed using precast concrete planks stitched together to decrease the installation time. These planks would then be stitched into the upstand formed from the adjacent sheet piles. This under road slab could have the sump section allowed for with a specific U type plank.

Once the under-road slab has been completed the surface water pumping system will need to be updated prior to the road surfacing being installed.

These works would not require a disruptive possession of the railway but would require staging works which would reduce the useable road width to a single lane and occasionally require full road closures. It is likely that an overnight closure of the road will be required to complete the work and tie the road surface together.

3.1.6.2.10 Stage 10 – Completion of side spans

The completion of the side spans can be undertaken outside of railway possession and can be staged to minimise disruption to road users by maintained three lanes of traffic for the majority of the works. This can be achieved by casting the remaining RC walkways in-situ or by making use of precast units lifted in by crane.

Once the RC walkways are complete the proposed deck spans can be installed.

Depending on the staging and detailed planning the West span (for the Up platform line) could be constructed at the same time as the main spans.

The final structure, with all decks installed, is shown in Figure 10.

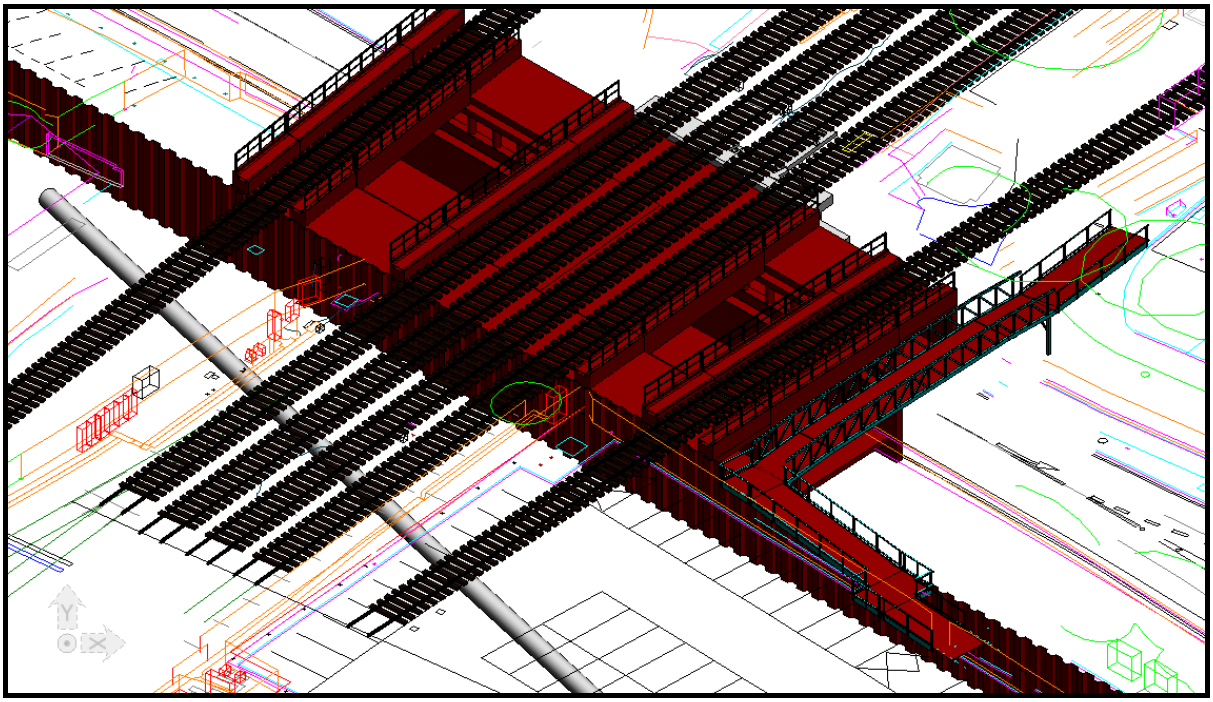

Figure 10 3D model extract at Botley Road, Completed Proposed Structure

3.1.6.3 Option 3 – Three Span Orthotropic Steel Deck

3.1.6.3.1 Stage 1 – Services diversion

Existing record information shows a large number of services within the existing road, separated footpath through the arch span and underneath the existing level crossing (Figure 5). All of these services will clash with the proposed structure and preparatory works.

It is proposed to divert these services into a micro tunnel to the South of Botley Road from the junction of Becket Street and Park End Street, underneath the station car park to the junction of Mill Street and Botley Road (Figure 6).

These works could take place during local diversions of traffic and should be able to progress without disruptive possessions of the railway. The tunnel may have to be stopped short of the existing sewer and the cables threaded through the sewer to the final tie in.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.1.

3.1.6.3.2 Stage 2 – Grouting Works

In preparation for the excavation of material currently below the water table, a water exclusion zone is to be created around the structure and approaches. The outline proposal for this is to install a grout curtain between existing ground level and the oxford clays below. A watering monitoring regime would be required prior to and after the grouting works to assess the efficiency of the grouting.

Grouting works could take place from the road way during night time single lane working. Where grout is required underneath operational tracks this could be undertaken from the adjacent car parks.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.2.

3.1.6.3.3 Stage 3 – North Abutment Stabilisation

A full assessment will required of the suitability of the existing North abutment to act as the permanent North abutment for the increased loading. This is likely to show that additional strengthening or underpinning of the abutment is required.

These works could be undertaken during night time, single lane working at road level. It is likely this work could be undertaken without a disruptive possession of the railway.

3.1.6.3.4 Stage 4 – South Abutment Installation

The new South abutment would be installed using sheet piling installed from track level. This would need to take place during a disruptive possession. A piling rig would be located at track level and the piles installed to below track level – either by cutting down the piles after installation or providing a lower piling platform than existing track level. (Figure 7)

The sheet piling could also be undertaken to either side of the railway to provide the new permanent retaining wall adjacent to the proposed footpath. The sheet piles can later be faced with brick/block work to provide a decorative face for the new structure.

If a reinforced concrete bearing shelf was preferred this would also have to be installed prior to the main installation works to allow the concrete to cure. If it was acceptable to weld the deck

directly to the sheet piles during the main possession this additional bearing shelf would not be required.

The works within the railway corridor would require a disruptive possession.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.3.

3.1.6.3.5 Stage 5 – Moving adjacent footbridge

The existing pedestrian footbridge from the station to the station car park is currently of insufficient span for the proposed road. The position of the existing structure is also a clash with the potential Up Island platform tracks. The footbridge will be located to the East of its existing location to avoid the potential clash with the proposed tracks and extended to land beyond the proposed road width. (Figure 8)

These works can be undertaken without a disruptive railway possession but would likely cause disruption to road users. The existing bridge could be retained in position during the erection of the proposed structure and potentially removed immediately after the erection of the proposed structure.

3.1.6.3.6 Stage 6 – Demolition of existing structure

Demolition of the existing structure is classed as the following activities:

- Removal of existing bridge decks
- Demolition of existing South abutments
- Lowering of existing road level
- Removal of all material North of the South pile wall

The demolition stage should remove as much material as possible to reduce the subsequent impact of road users during completion stages.

Providing a longer central ballasted span in place of the existing single direct fastened span will lead to an increase in construction depth. As the track level must be maintained due to the adjacent platform this means that the existing road level much be lowered prior to installation of the proposed deck to ensure that the existing 4.2m clearance is maintained.

These works would require a disruptive possession of the railway and closure of the road.

For discussion on the risks and opportunities associated with this stage see Section 3.1.8.4.

3.1.6.3.7 Stage 7 – Installation of Proposed Structure

The installation of the proposed structure is classed as the following activities:

- Installation of central combi sheet piles for piers
- Installation of North cill unit
- Installation of proposed main deck span

Installing sheet piles for the central piers provides a cofferdam which will aid the construction and installation of the under road slab and means that excavation of the road down to the final level can then take place. Each sheet pile could then have shear studs attached and a concrete

face formed on the piers. This method would create completely enclosed walkways which may not be acceptable to Oxford City Council.

The existing cill unit on the North Abutment would need to be broken down to allow the proposed pre-cast concrete cill unit to be installed. The existing cill unit consists of a precast pilecap which is connected to the piles via post-tensioned Macalloy bars (record drawing C.31677) and that sits on a rubber bearing onto the existing abutment. A ballast retaining wall will also be required – this could be incorporated into the new cill unit or installed separately.

Once the piers and North Cill unit is place the main deck can be installed. Due to the 14m width of the main deck it is likely that the deck will have to be transported to the site in 4 segments and welded together on site. Each 4m segment would weigh approximately 50T, be 3.5m wide and 19m long. The complete main deck would then be installed.

Once the new railway deck is in place ballast and track would be installed and the OLE would be re-wired and energised.

3.1.6.3.8 Stage 8 – Installation of substructures

To tie the sheet piles into the central under road slab a cast-in situ concrete upstand will be required to cover the sheet piles adjacent to the proposed road surface. This can be achieved by friction welding studs onto the sheet piles.

The main under road slab could be installed using precast concrete planks stitched together to decrease the installation time. These planks would then be stitched into the upstand formed from the adjacent sheet piles. This under road slab could have the sump section allowed for with a specific U type plank.

Once the under-road slab has been completed the surface water pumping system will need to be updated prior to the road surfacing being installed.

These works would not require a disruptive possession of the railway but would require staging works which would reduce the useable road width to a single lane and occasionally require full road closures. It is likely that an overnight closure of the road will be required to complete the work and tie the road surface together.

3.1.7 Possession strategy for all options

All three of these options are designed and ordered to allow the works to take place in a single or multiple possessions. This has been done by eliminating the need to re-open the railway based on wet trades such as cast in situ concrete or pile installation. The sequence outlined above generally provides for a section of preparation works followed by a section of disruptive possession works and a final section for completion works.

Initial construction programmes have been developed to provide an estimate of the time required to complete the works in a single or multiple possessions. These show that if all works were undertaken in a single possession this would require a single 101 hour blockade. If this length of possession was not available an alternative would be to utilise two 78 hour blockades.

The use of two 78 hour blockades will mean a period of disruption to road users between possessions as well as the approximately 12 weeks leading up to the first possession and approximately 8 weeks after the final possession to finalise the road alignments.

A single 101 hour blockade would cause disruption to road users in the approximately 12 weeks leading up to the possession and approximately 8 weeks after the possession to finalise road alignments.

If a single possession was used it is assumed that each option would have the following order.

3.1.7.1 Option 1 – Single 19m Span Steel Orthotropic Deck

Preparatory works:

Stage 1 – Services diversion

Stage 2 – Grouting Works

Stage 3 – North Abutment Stabilisation

Stage 4 – Moving adjacent footbridge

Stage 5 – South Abutment Installation (majority)

Possession works:

Stage 5 – South Abutment Installation (railway section only)

Stage 6 – Demolition of existing structure

Stage 7 – Installation of proposed structure

Stage 8 – Construction of under road slab and road surfacing (potentially)

Completion works:

Stage 8 – Construction of under road slab and road surfacing

3.1.7.2 Option 2 – 10m Orthotropic Steel Deck with RC Walkways

Preparatory works:

Stage 1 – Services diversion

Stage 2 – Grouting Works

Stage 3 – North Abutment Stabilisation

Stage 4 – Moving adjacent footbridge

Stage 5 – South Ground Stabilisation (majority)

Stage 6 – Slide Track Preparation

Possession works:

Stage 5 – South Ground Stabilisation (railway section only)

Stage 7 – Demolition of existing structure

Stage 8 – Installation of proposed structure

Stage 9 – Installation of substructures (potentially)

Completion works:

Stage 9 – Installation of substructures

Stage 10 – Completion of Side Spans

3.1.7.3 Option 3 – Three Span Orthotropic Steel Deck

Preparatory works:

Stage 1 – Services diversion

Stage 2 – Grouting Works

Stage 3 – North Abutment Stabilisation

Stage 4 – Moving adjacent footbridge

Stage 5 – South Abutment Installation (majority)

Possession works:

Stage 5 – South Abutment Installation (railway section only)

Stage 6 – Demolition of existing structure

Stage 7 – Installation of proposed structure

Stage 8 – Installation of substructures (potentially)

Completion works:

Stage 8 – Installation of substructures

3.1.8 Risks and Opportunities

With the construction sequences proposed above there are a number of risks and opportunities in the assumptions made to inform the sequence. These are explored in more depth in the following section.

3.1.8.1 Existing Services and Diversion Options

Record information about services in the area indicate that there are a large number of services passing through the road, under the existing pavement and underneath the emergency level crossing to the South of the Bridge. These services will need to be diverted to enable the permanent works to be installed.

To divert these services it is proposed to install a micro tunnel to serve as the service route. This would allow all services to be diverted away from the road and reduce risk on cable diversions needing to be staged and carefully managed during the work. The micro tunnel could also be sized to provide sufficient capacity for reasonable increases in services – this would have the benefit of reducing the impact on local road users if additional services are required in the future.

An alternative method of temporary diversion would be to attempt to divert the services in a staggered fashion requiring multiple diversions. The final diversion would see the services diverted to their final location. This alternative is not seen as feasible as each diversion would have an associated cost.

Of note is also the GSM mast to the South East of the Railway Underbridge, adjacent to the station footbridge. This mast will require relocation as part of the works to widen the structure. Negotiations should be entered as soon as possible for the relocation of this mast.

3.1.8.2 Grouting and Alternative Water Control Measures

As the current road level beneath the bridge appears to be at or just below groundwater level, groundwater is considered a significant factor in assessing the design proposals for the bridge. When the road is deepened, the depth below groundwater level will be increased. Therefore groundwater will need to be addressed in the permanent works design. To allow for workable dry conditions for the Botley Road bridge works, groundwater control will be required. The key parameters of groundwater control for the Bridge construction can be summarised as:

- Excavation to be made to an approximate level of 53.5mAOD (which is 2.0 m below groundwater level based on piezometer data, or 3.2m below groundwater level based on data from BH01 borehole log)
- Deepest excavation will bottom out in River Terrace Deposits which are indicated to be highly permeable (of the order of 10^{-3} to 10^{-4} m/s) and to extend 3m to 4m below deepest dig level, where they are underlain by very low permeability Oxford Clay
- There is potential for contamination to be present in the groundwater in the River Terrace Deposits in the vicinity of the Bridge

- The Bridge is in a urban area, surrounded by existing structures, services and infrastructure, and the superficial strata at the site are potentially compressible
- Access to the excavation area is restricted by existing structures and foundations, road and railway lines, particularly to the south where the new abutment is to be located; and
- Key stages of the construction works are likely to be carried out during railway possessions. It would be advantageous to use a groundwater control method that can be installed in advance of the main works, and to be able to prove the effectiveness of the system (by testing) prior to commencement of the main works

There are two principal approaches that can be used to control groundwater for the proposed works; pumping and exclusion. The suggested options for each approach are discussed below.

Table 2, captures the key advantages and disadvantages for the identified groundwater control options.

Groundwater Control method	Advantages	Disadvantages
Pumping	Due to the high permeability of the gravels, it is likely that pumped wells can be relatively widely spaced, and potentially be laid out in an irregular pattern, to fit in around existing structures or obstructions. The installation of widely spaced wells is unlikely to be disruptive to the local area in advance of the main construction works.	It will lower groundwater levels over a wide area around the Bridge (potentially to a distance of several hundred metres from the dewatering system) with the corresponding risk of ground settlement or contamination migration. It will also be necessary to dispose of the pumped flow rate, which may potentially be contaminated. Temporary works solution that will deal with groundwater during construction only. Design solution need to provide dry conditions within the road in the permanent condition.
Exclusion	Small requirement for groundwater pumping, only required to pump out water trapped within the low permeability barrier and residual seepage through the barrier. Limited potential impact of ground settlement. Limited potential for mobilising groundwater contamination. Solution may support the permanent exclusion of groundwater from Botley Road.	It requires a continuous barrier to completely enclose the excavation. This barrier must cross Botley Road to the east and west of the Bridge, and the railway line to the north and south of the Bridge. Work within Botley Road and for the North Abutment will require work within the roadway (and work on the North Abutment will have to be carried out under low headroom conditions). The barrier for the South Abutment is particularly challenging as it will have to be located beneath the railway line, south of the existing Bridge.

Table 2 Review of groundwater control advantages and disadvantages

3.1.8.2.1 Groundwater Control by Pumping

The information reviewed indicates that groundwater control by pumping (to lower groundwater levels below dig level) is feasible in principle. This conclusion is justified because the required drawdown is relatively modest, the gravels are permeable and free-draining, and there is a defined low permeability base to the River Terrace Deposits aquifer (the underlying Oxford Clay).

Any groundwater control design (by whatever method) will be strongly influenced by the access and programme restraints. At this stage, a conceptual groundwater pumping scheme would comprise:

- Drilled wells penetrating through the River Terrace Deposits to terminate in the underlying Oxford Clay, located in an array around the proposed excavation
- At this stage, in anticipation of high pumped flow rates, the wells should be of relatively large finished diameter (minimum 200mm), which would require drilling at a diameter of 300mm or greater
- The wells would be relatively shallow, with a toe level of approximately 48mAOD (assuming the top of the Oxford Clay is at 49m AOD to 50mAOD); wells drilled from 60mAOD would be up to 12m deep, while wells drilled from within the lower levels in the road area would have correspondingly reduced depths
- The normal method to pump these wells would be to use electric submersible pumps, but if high flow rates are encountered there may be options to pump any wells at lower level with suction pumps, or once excavation begins, to augment the wells by pumping from sumps within the excavation
- There may be a requirement for additional piezometers to monitor groundwater levels around the Bridge during the construction period

Scoping level dewatering flow rate calculations, captured within the TSP Ground Investigation Report, predict a steady state pumped flow rates of 20 to 35 l/s.

3.1.8.2.2 Groundwater Control by Exclusion

The information reviewed indicates that groundwater control by exclusion (using low permeability barriers to prevent groundwater from entering the excavation) is feasible in principle. This conclusion is justified because the gravels are relatively coarse and appear within the particle size range which can be successfully grouted, the thickness of River Terrace Deposits aquifer to be cut off is relatively limited, and there is a defined low permeability base to the River Terrace Deposits aquifer (the underlying Oxford Clay) into which a barrier can be keyed.

Any groundwater control design (by whatever method) will be strongly influenced by the access and programme restraints. At this stage, a conceptual groundwater exclusion scheme would comprise:

- A grout curtain to form a low permeability barrier around the proposed excavation area. The method of grout placement would be permeation grouting from vertical and inclined boreholes. The grout holes would be closely spaced and relatively shallow, penetrating

down to the top of the Oxford Clay, and penetrating into it for a short distance to form a seal.

- The assessed hydraulic conductivity of the River Terrace Deposits indicates that conventional OPC cement-based grouts may not be suitable, and that micro-fine cement or colloidal silica grouts may be required (reference Table 3 of BS EN 12715: 2010 [29]).
- Where there is suitable access, it is possible that some part of the grout curtain could be substituted by sections of vertical sheet-piles, which may allow sections of the groundwater barrier to be removed on completion.
- It is unlikely that the initial grout curtain will be entirely watertight, and some sump pumping will be required to remove water trapped within the area enclosed by the grout curtain and to deal with any seepage through the curtain. It is possible that some remedial sealing measures will be required to deal with localised seepages revealed during excavation. It should be highlighted that the water pumped may be contaminated and may require similar water treatment as discussed for the groundwater pumping option.
- There may be a requirement for additional piezometers to monitor groundwater levels around the Bridge during the construction period.
-

3.1.8.2.3 Risks and Opportunities

With the construction sequences proposed above there are a number of risks associated with managing the ground conditions. Table 3, captures the principle risk associated with the identified groundwater control options discussed.

Risk Factor	Potential Impact	Possible Mitigation
Groundwater control by pumping		
Excessively high hydraulic conductivity of gravels	High pumped flow rate, requiring additional pumping capacity, potentially causing problems for water disposal	Hydraulic conductivity testing in existing piezometers Well pumping test Dewatering calculations with sensitivity analysis Flexible dewatering system, including sump pumping Commence dewatering installation early in programme
Very high groundwater levels during heavy rainfall and flood conditions	Requirement for increased pumping capacity Risk of surface flooding affecting dewatering system by flooding equipment and power supply, causing pumps to stop	Long term monitoring of groundwater levels, and review of potential hydraulic linkages to rivers Protect vulnerable equipment from risk of surface water flooding
Presence of contaminated groundwater	Pumped discharge is contaminated (e.g. with hydrocarbons) Groundwater treatment plant (and associated EA permits) is required to allow water to be discharged	Groundwater sampling and analysis from existing piezometers Groundwater sampling and analysis during pumping test

Risk Factor	Potential Impact	Possible Mitigation
Groundwater control by pumping		
Ground settlement	Drawdown of groundwater levels causes ground settlement Potential damage to neighbouring structures Potential impact on railway operations	Analytical calculations or numerical modelling to estimate zone of drawdown around dewatering system. Assessment of consolidation settlement and associated risk of damage and impact on railway Pre-construction building condition surveys in zone affected Programme of building and rail level monitoring during dewatering
Dewatering achieves insufficient drawdown, or drawdown is too slow	Programme delays, missed possessions	Hydraulic conductivity testing in existing piezometers Well pumping test Dewatering calculations with sensitivity analysis Flexible dewatering system, including sump pumping Dewatering system tested and proven in advance of possessions
Inadequate sewerage capacity to accept pumped discharge water	Programme delays	Review existing sewerage capacity in area and engage with sewerage provider Dewatering calculations with sensitivity analysis (to provide flow rate estimates) Investigate alternative water disposal route to river and engage with EA regarding necessary permits
Groundwater control by exclusion		
Difficult access and sequencing of barrier installation	Disruption to road and rail traffic during installation of groundwater barrier Programme delays, missed possessions Inability to achieve closure of groundwater barrier	Develop geometry and working sequence for groundwater barrier Enabling works to remove any existing obstacles or physical constraints prior to barrier installation Commence barrier installation early in programme
Very high groundwater levels during heavy rainfall and flood conditions	Groundwater barrier is overtopped at eastern and western ends (Botley Road) and excavation floods Surface water flooding reaches excavation	Long term monitoring of groundwater levels, and review of potential hydraulic linkages to rivers Contingency pumping or surface barriers in the event of very high groundwater levels or surface water flooding
Presence of contaminated groundwater	Pumped discharge (from groundwater inside barrier and from seepage through the barrier) is contaminated (e.g. with hydrocarbons) Groundwater treatment plant (and associated EA permits) is required to allow water to be discharged	Groundwater sampling and analysis from existing piezometers
Groundwater barrier is not fully effective and significant external draw downs occur	Programme delays, missed possessions	Grouting trial Groundwater barrier tested and proven in advance of possessions
Permanent presence of groundwater barrier affects	Groundwater levels rise up gradient (north) of Bridge and fall down gradient of Bridge	Groundwater modelling to determine long-term effect of groundwater barrier.

Risk Factor	Potential Impact	Possible Mitigation
Groundwater control by pumping		
groundwater levels around the Bridge	(south) Rising groundwater levels may cause basement flooding Falling groundwater levels may cause ground settlements	Groundwater barrier to be breached on completion (by removal of sheet piles or by excavation

Table 3 Risk register for groundwater control solutions

3.1.8.3 Sheet Piling and Soil Slope Stability

All options make use of sheet piling to provide temporary stability to the soil or a permanent abutment / piers / retaining structure.

Sheet piles were selected as they serve to minimise the risk to the overall project. The soil conditions of River Terrace Deposits overlaying Oxford Clay are suited to the use of sheet piling although there is a risk of pile refusal associated with installing these through the areas of made ground above the natural deposits.

When these are installed on the South Abutment the ground to the North of the sheet piles can be removed with minimal monitoring or risk of undermining the sheet piles. This reduces risk to the operatives undertaking the excavations and makes possession over-run less likely.

An alternative solution would be to improve the made ground in the area to allow a steep angle of repose to be left to cutting faces – this would mean less operations on site during the possessions and potentially reduce the time taken to complete works during the possession. However the use of this method has associated risks of slope failure. This poses a potential safety risk to the operatives undertaking excavations and could also pose a project risk by causing the possession to over-run.

Where sheet piles are used for permanent support these have been chosen due to the fact that once installed they can immediately carry their designed load. This means that main foundations can be installed during a single possession and removes the need for preparatory possessions.

3.1.8.4 Demolition methodology of existing spans

The aspiration from Network Rail to provide ballasted track over the bridge and the increase in span means that the soffit level of the bridge will lower by approximately 600mm. To maintain the existing 4.2m clearance this means that the road level needs to be reduced prior to the new bridge deck being installed. This will require the road surface to be skimmed down by approximately 600mm. Cores taken from road level indicate that there is a minimum of approximately 600mm from the road surface to the brick invert.

The other constraint to consider is the sump known to be in this area. It is recommended that at the next stage the location and exact size of this sump is confirmed and a check undertaken of the ability to lower the road prior to installing the new bridge deck.

A concern about this stage is the temporary routing of pedestrians and vehicles – especially provision for emergency access across the railway corridor. There is an alternative pedestrian access at Cemetery Road which is approximately a 500m diversion onto a stepped footbridge. The road diversion would likely involve diversions onto the A420 / A4144 and the Oxford ring road. This is a significant diversion for emergency services and would need to be agreed with the Council and local emergency services.

Demolition of the existing main spans could be undertaken one by one via a large crane based in the Station car park – however as the works are proposed to take place in a single possession there is a risk that adverse weather, such as high winds, could prevent the crane from being used to remove the structure.

An alternative would be to remove the existing spans with a Self Propelled Modular Transporter (SPMT). To enable this option a haulage road would need to be created from the site compound down to the existing site of the bridge. Material excavated to the South of the existing road prior to the demolition of the structure could be recovered, processed on site and reused as fill material for reducing the angle of the slope.

3.1.8.5 Construction Methods for the RC Walkway

Option 2 discusses the creation of a jacking slab to allow the North and South RC walkways to be jacked into place during the possessions. This is proposed as cranes could be affected by adverse weather. A large tonnage crane could be located in the adjacent station car park / site compound area during the possession. Due to the weight of the units these may have to be lifted in sections then grouted and post-tensioned on site to provide a watertight seal. If crane installation was chosen over sliding stage 6 could be ignored.

It should be possible to create jacking slabs to the East of the existing structure and use these to jack across sections for the North and South Walkway. These jacking structures would need to be 20m long from the existing structure to back of jacked structure to provide some working room around the require 16m long sections of RC walkway to go underneath the main span.

Additional sections adjacent to the main span could then be cast in place and tied into the pre cast sections.

3.1.8.6 Permanent Foundations and Uplift

Ground investigation undertaken to date indicates that the ground conditions below the proposed structure will typically be River Terrace Deposits with Oxford Clay below. This needs to be confirmed with local boreholes as structural core holes have located clay directly behind the North abutment.

Because of the relatively low area loading through the floors of the RC walkways it is assumed that the River Terrace Deposits will be capable of supporting the RC walkway boxes in bearing. However because of the high water table the structure will be under significant uplift forces and will require piles to resist this load.

3.1.8.7 Installation methodology of main orthotropic span

The current proposal for installation of the main orthotropic deck is to use a large tonnage crane located in the adjacent station car park / site compound area during the possession. This imports a project risk as adverse weather could mean the crane is unable to operate safely and this would cause the possession to overrun or be abortive.

An alternative method of installation would be to use a self propelled modular transporter (SPMT). This could be used to travel the main deck from the site compound, under the proposed footbridge (this option doesn't work if the existing footbridge is still present), and onto the proposed abutments. To enable this option a haulage road would need to be created from the site compound down to the proposed site of the bridge. This haulage road could be partially created from material recovered on site during the excavation works.

Additional temporary works such as removal of traffic lights and street furniture may also be required to provide a clear space for the deck to travel through.

3.1.8.8 Vehicle and Pedestrian Routing throughout works

The confined site combined with the complex sequencing of works required means that public vehicle and pedestrian movements will need to be considered at each stage of the works to ensure that a safe route is available whenever possible. This may include re-sequencing of adjacent traffic lights and installation of temporary pelican/toucan crossings.

Protracted use of single lane road working will have a significant effect on local road traffic. The road diversion would likely involve diversions onto the A420 / A4144 and the Oxford ring road. This is a significant diversion for emergency services and would need to be agreed with the Council and local emergency services.

Existing traffic flows observed during site visits show that this road is already heavily congested during the majority of the day and night.

3.1.9 Recommendations

Option 2 is recommended as it offers a number of benefits by reducing risk during installation, minimising impact to both rail and road users as well as reducing project risk by not re-using the existing North abutment.

At this stage of study, both groundwater pumping and groundwater exclusion options appear feasible in principle. However, both options have issues that need to be addressed before they could be chosen as a preferred option.

For groundwater pumping options the key issues are to assess:

- Whether the external drawdown in the zone of influence around the dewatering system would cause unacceptable impacts in terms of ground settlement (of nearby buildings or of rail level). While compressible strata are present in the Made Ground and Alluvium, the thicknesses of these strata below the groundwater table are limited. While consolidation settlements will occur, the magnitudes are likely to be relatively modest (no calculations have been carried out in the current study),
- the external drawdown in the zone of influence around the dewatering system would cause unacceptable impacts in terms of contamination migration; and
- Whether the pumped flow rate can be disposed of (in terms of quantity) and whether the discharge may be contaminated and may require treatment prior to disposal.

For groundwater exclusion options the key issues are to assess:

- Whether an effective grout curtain can be formed, given the restricted access and existing structures in place that may restrict the drilling of grout holes in the ideal locations.
- Whether, following completion of construction, the long-term presence of a low permeability barrier would cause unacceptable impacts in terms of changes in groundwater level local to the Bridge.

It should be noted that the proposed works will deepen the section of Botley Road where it extends below groundwater level beneath the Bridge. The permanent works design should address the relevant issues, including uplift loads and/or the requirement for permanent drainage of the road.

The use of the two RC Walkways to support the ballasted track with a short 10m orthotropic steel deck span provides a shallower construction depth than a single 19m span. It also provides segregation between pedestrians and vehicles whilst maintaining an open feeling walkway.

By not re-using the existing North abutment the project removes the risk involved with the works required to safely cut down the existing pile cap to allow the new cill unit and deck to be installed during a possession.

By tying the walkways into the main road slab via the sheet piled wall a barrier is created which should prevent the majority if not all of the ground water from entering into the surface water drainage system.

This option also provides flexibility in the install method with Strand jacking, SPMTs or cranes available for the installation of various elements. This flexibility at this stage means that there may be room for improvement on installation times by phasing the works with multiple sets of equipment rather than relying on the movements and capacity of a single large capacity crane.

Some further considerations for Option 2 are highlighted below.

3.1.9.1 Collision Loading to RC Walkway Columns

Feedback from Oxford Council has indicated that they do not wish the pedestrian / cycleway areas to be seen as threatening environments and would prefer these to be open sided. The RC walkways are currently designed as having 500mm diameter circular columns every 2m, along with the 1m high Reinforced Concrete parapet this gives an area of approximately 1.5m wide by 1m high between columns (Figure 11). This should help to reduce the perceived threat by providing the feeling of open space under the bridge.

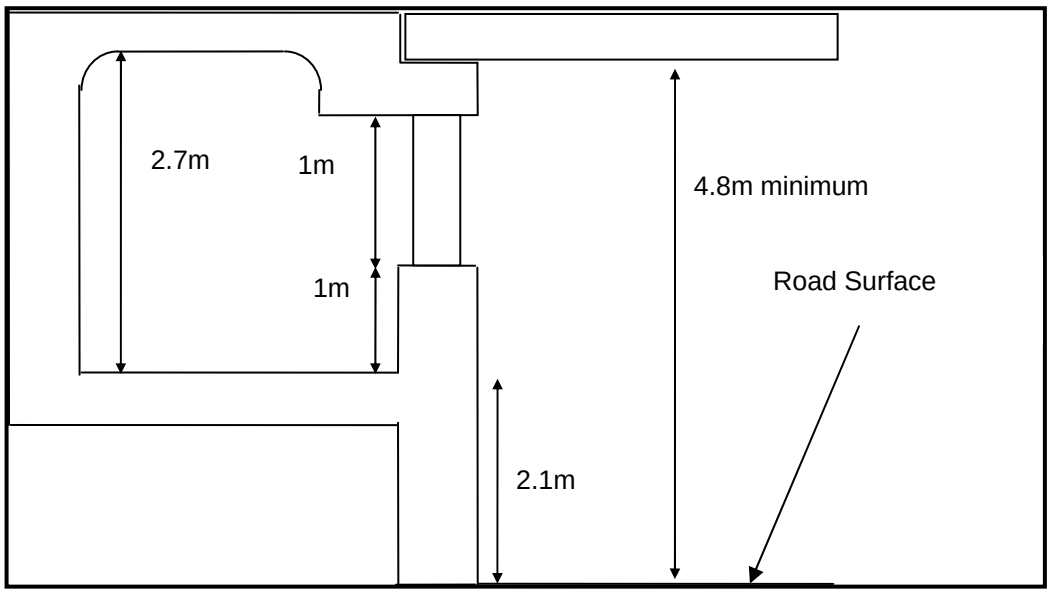

Figure 11 Indicative Cross Section through RC walkway at Botley Road

BD 60/04 – The design of highway bridges for vehicle collision loads – Section 2.3 has a requirement for nominal loads acting on bridge supports over Highways. The proposed circular columns will not be able to resist the loads stated in the table without significant additional reinforcement – but the 1m high Reinforced Concrete parapet up stand could be designed to with minimal additional reinforcement. The East Elevation of the structure is shown in Figure 12.

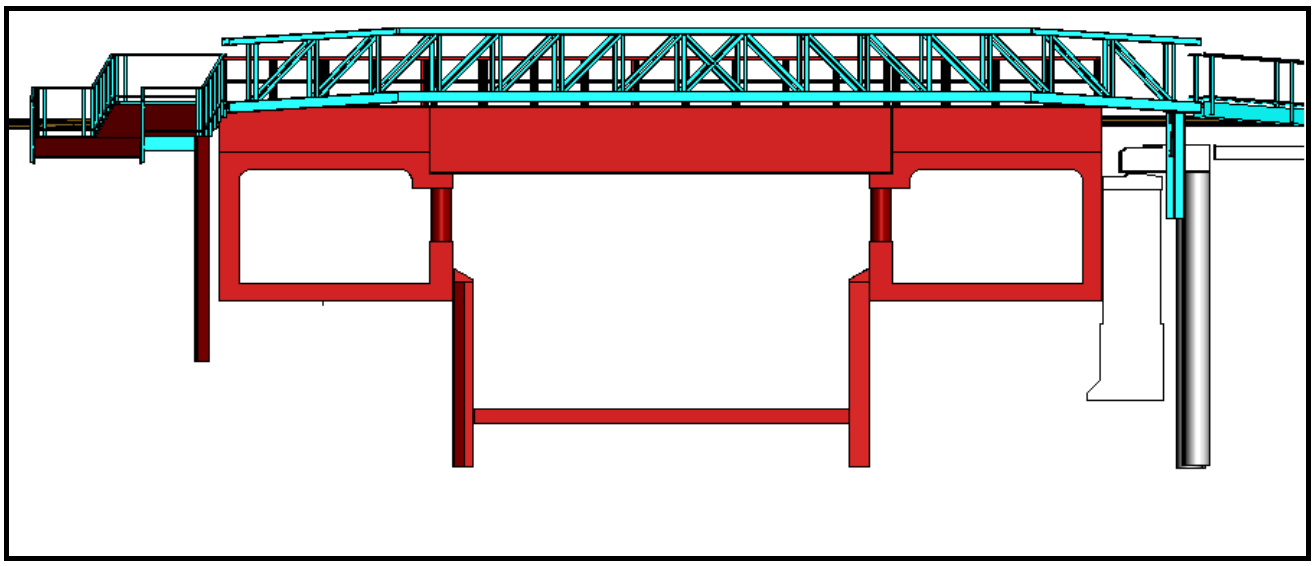

Figure 12 Botley Road East Elevation (Bridge elements only shown for clarity)

3.1.9.2 Extent of RC Walkways

The installation of the RC Walkways underneath the main span is proposed for constructability reasons; therefore the minimum extent of the walkways is 16m underneath the Up and Down Main and Loop lines. The proposed Up and Down island platform lines will also require abutments and piers to reduce the construction depth of the deck. The abutments will be required to retain additional material built up to rail level as well as supporting the bridge deck.

The piers and abutments could be structurally independent but due to the requirement of the abutments to also act as retaining walls these would likely extend to the walkway abutment. As the Up platform line is not currently funded in CP5 this has the risk of leaving abutments and piers with no bridge deck which could become an eye sore for local residents.

As an alternative the RC walkways could be extended so that they act as the piers and abutments for both the Up and Down Island Platform Lines. If they were extended under the Down Island platform line only they would increase to approximately 30m in length. If they were extended under both the Down and Up island platform line they would increase to approximately 40m in length.

The extensions beyond the main span could be cast in situ or precast units with local stitches into the main span sections.

Where the walkway is not directly supporting a deck the cross section could be altered to an L type structure. This would save slightly on material costs, provide more natural light and prevent the 40m long tunnel from seeming too enclosed. An example of this cross section is shown in Figure 13.

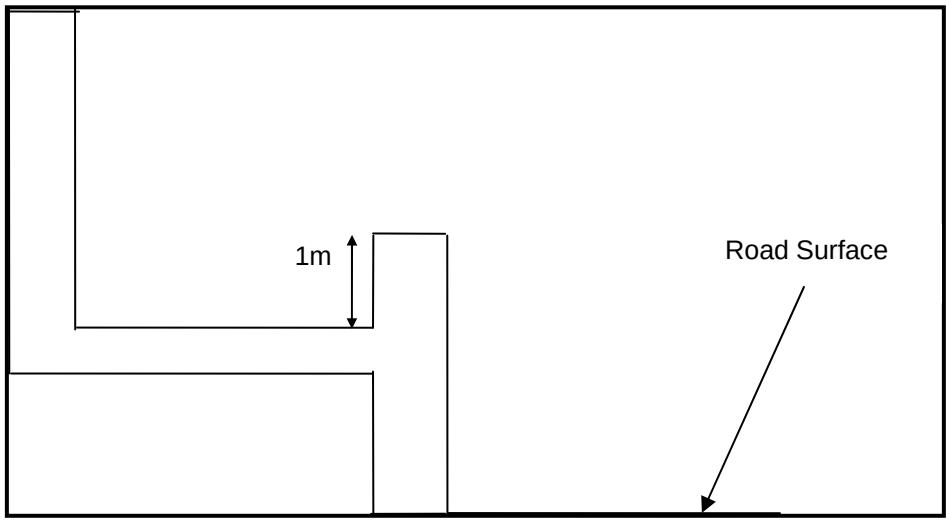

Figure 13 Botley Road Bridge, Option for Cross Section through non-deck section

3.1.9.3 Level of Up and Down Island Platform Lines

By providing 4.8m headroom under the proposed Up and Down island platform lines the extent of road lower under the main span provides a clearance of approximately 5.3m. This clearance has been arrived at on the assumption that both the Up and Down lines are co-planar with the existing four central lines. If the restriction for co-planar tracks was removed then the limitations on the level of the Up and Down island platform lines relate instead to the existing platform levels and Track tie ins.

This has shown that there are four options for increasing the level of the Island platform lines above the main lines. These are as follows:

- 0mm – Better than compliant platform falls, central flat area for stairs and lift tie ins.
- 68mm – Minimum compliant platform falls, central flat area for stairs and lift tie ins.
- 141mm – Minimum compliant platform falls, no central flat area for stairs and lifts which creates difficult tie ins.

300mm – Minimum compliant platform falls only achieved with a central step in the platform. This restricts the level access from lifts to both platforms by routing down the platform until a suitable ramp is possible.

3.2 Highways (including associated junction remodelling where required)

3.2.1 Remit

TSP has been commissioned by Network Rail to provide a highway design solution for Botley Road to accommodate new track layout at Oxford Station.

Oxford City Council and Oxford County Council have aspirations to improve Botley Road at the same time as the rail works. The specification for this would form a sub-option to sit as add-ons to the main rail scheme. Headroom must be considered in the Highway Design to accommodate the usage of full height London Buses. Botley Road proposals are within the extents of Junctions Mill Street and Cripley Road to the west, and Becket Street to the east. TSP designs are within the limit of these junctions, where known junction improvements under the Oxford Council Master plan are proposed.

The Councils intentions are principally to allow a shared use cycle/footway on both sides of the road (presently only narrow paths which are not suitable for cyclists), to achieve three lanes of traffic (presently two) and to achieve a better headroom clearance. This is achievable by raising the railway or by lowering the road or a combination of both

Following discussions with Oxford City and County Councils we have agreed a proposed road configuration, which has a full width of 19.2m (as against the present bridge width of 9m) but the combined width of the present under bridge and the adjacent level crossing means that theoretically the new proposal will fit within the present 'highway' boundary, keeping the north abutment where it is at present.

The Councils are obviously keen to ensure that the road gradient doesn't extend into the junctions either side of the bridge (Fridewides Square on the east and Roger Dudman Way/Abbey Road/Mill Street on the west). One way of assisting this will be to divert Roger Dudman Way end into Abbey Road and then to join Botley Road as a single junction.

The council's specification for the highway is as follows:-

Item	Existing	Proposed
Footway width	N/A	2.5m x2=5m
Cycle path width	N/A	1.5m x2=3m
Carriageway width	N/A	3m x 3 plus 2 off safety kerbs, railings etc=11.2m, 0.2m allowance for the retaining wall between the cycleway & 0.6 safety kerb each side
Total width	9m	19.2m
Height	4.22m headroom. Actual 4.28m	Required absolute minimum is 4.80m
Gradient	N/A	6% desirable (10%) minimum with approval
Lighting	OCC	OCC to continue to provide
Drainage	NR pumped	Network Rail to continue to provide pumped system

Table 4 Botley Road Highway Design specification

3.2.2 Highway Standards in accordance with DfT and Oxford Council

Highway standard TD36 (Subways for Pedestrian and Pedal Cyclists) allows a shared use 'unsegregated' subway of height 2.4m (2.7m if the subway is more than 23m long) and 4.0m width is proposed, so the council proposal is the absolute minimum allowable by TD36 standards.

Highway standard TD27/05 (Cross-Sections and Headroom's) calls for minimum lane width of 3.6m, so we already appear to have a significant concession. The standard calls for a height of 5.30m for new construction or 5.03m as an absolute 'maintained' minimum for existing bridges for e.g. carriageway re-surfacing etc. To both of these should be added another allowance for 'sag' based on the radius of the downgrade to under the bridge to the upgrade. DMRB standard calls for 5.48m. The councils have however accepted that full compliance is not achievable and, as other main routes into the centre are compliant, they are prepared to lower the requirement to 4.80m (plus sag) which is based on being able to use 'London specification' double deck buses, which are more economically available than the present Oxford special specification (which is even smaller). The road although having 4.8m headroom clearance will be signed for headroom 4.5m/14'9". The carriageway width is made up of 3 lanes at 3m wide, a 0.6m safety kerb each side, a 0.3m parapet wall/fence to the cycleway and a 0.2m allowance for the retaining wall between the cycleway and road to be at a 5% batter. The retaining wall should be smooth faced, to withstand vehicle impacts.

TD36 says that foot/cycleways should ideally be 5%, should preferably be 8% and if severe difficulties can be 10% absolute maximum. The 6% figure quoted above is the Councils requirement for the foot and cycleways, which should be achievable, as these can be significantly shallower than the road depth. The road gradient shall as an absolute minimum be no worse than the existing road gradient, but an improvement would be useful. The minimum compliant vehicle gradient is 10%.

The main issue is the height and the fact that the existing dip in the road is already below the water table (drainage is managed by Network Rail via a pumped system). The height is not currently sufficient for a standard double-decker bus and Oxford's bus operators have their stock specifically made to go under this bridge. In renewing this bridge it is required to see this addressed to avoid special purchases being made in the future. However, this can only be achieved by a slimmer bridge deck, further lowering of the carriageway or raising the track. Lowering of the carriageway is what we have proposed.

3.2.3 Highway Geometry – Option 1

The proposed vertical profile has been modified to accommodate two proposed extra bridges and comprises of a vertical curve of 475m maximum radius and the maximum proposed gradient at the western end is 6.18% to tie-in before the junction of Mill Street & Cripley Road, to the east the maximum gradient is 9.83% which is allows a tie-in before Frideswide Square, this is steeper than the desirable 6% and will require approval from Oxford Council to proceed.

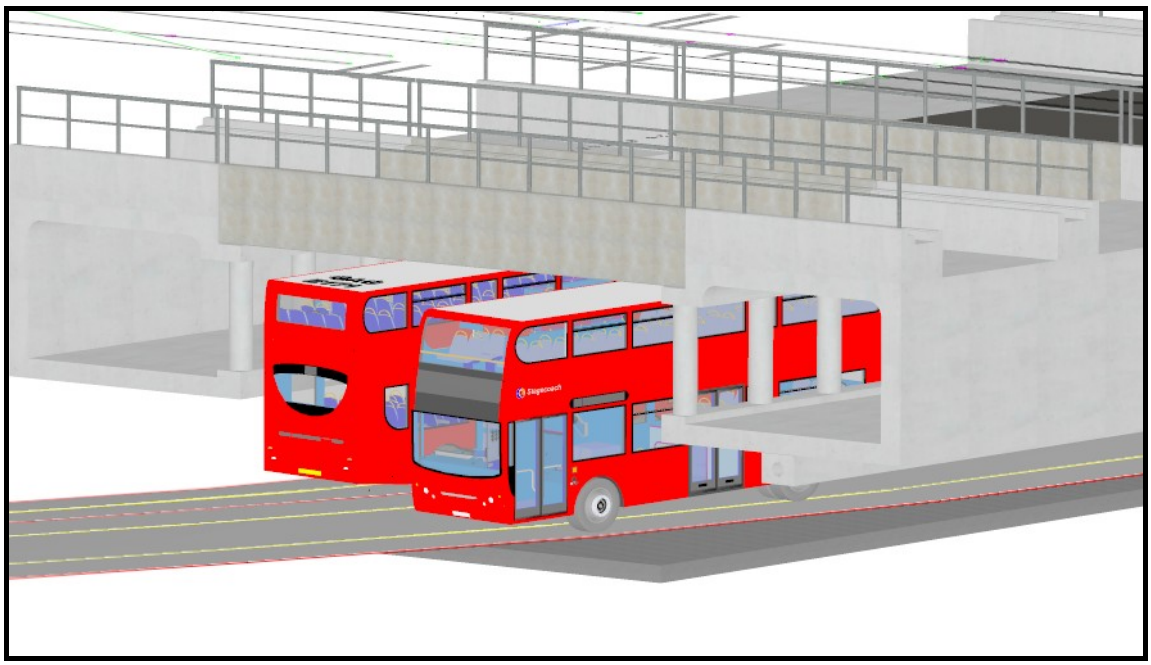

Figure 14 View from South West of 'London buses' passing under proposed span for New Platform 5

The proposed alignment will have a cambered crossfall of 2.5%. A vertical clearance of 4.8m requested by Oxford Council at the pinch points of the proposed bridges has been achieved by lifting the two proposed bridges by 100mm above the existing bridge level. Visibility at sag curves is not usually obstructed, unless over bridges are present, in this case lowering the road beneath the over bridges would clearly improve visibility and in this based on forward visibility of a double decker bus through the bridge is an improvement on existing by (Eastbound) 5.7m & (Westbound) 2.5m.

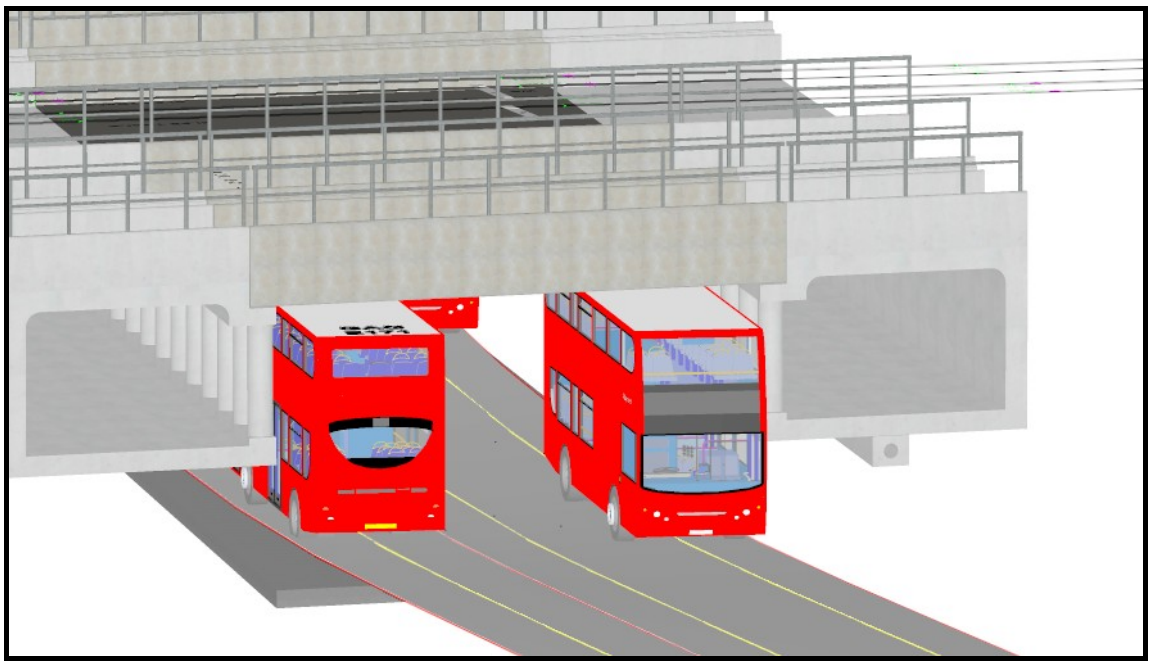

Figure 15 View from West of continuous sag Option 1

3.2.4 Highway Geometry – Option 2

Following a review of Option 1 with Network Rail, TSP was asked to reduce the depth of excavation with an alternative option and consideration has been given to an alternative vertical profile, which will utilise a zero longitudinal gradient beneath the existing bridge and two proposed bridges to achieve 4.8m headroom clearance. It will be achievable utilising vertical curves to tie-in to existing ground before the adjacent junctions and this option will also minimise the depth of excavation. The proposed alignment will have a cambered crossfall of 2.5%.

Utilising the level option will mean effectively there should not be any need to raise the proposed bridges to accommodate Oxford Councils desired 4.8m Headroom Clearance, and the underside of the proposed bridges could be set at the same level of the existing bridge, However their will be obvious benefits of staying with the proposal of lifting the proposed bridges by 100mm to enable a tie-in to existing sooner..

Both options will need to be considered by both Network Rail and Oxford council and a decision made on the preferred option to progress to detailed design. Both longsections can found on the Botley Road Sketch W1002B-TTS-SKE-EHW-703001 Vertical Profile Indications.

3.2.5 Junction Geometry

It is not known if the continuation of the carriageway widening will continue further along to the junctions of Mill Street and Becket Street, if this is the case a junction re-alignment will be needed at these areas to accommodate the widening. The proposed carriageway is shifted to the south then tapered back to the existing alignment within the limits of the existing junctions. The aim is to be no worse than existing if this cannot be achieved then maximum limits will be achieved in accordance with the council's departure/approval process.

3.2.6 Design Parameters

The existing vertical alignment and headroom for Botley Road is below the standards given in TD 9/93 (Highway Link Design). The minimum design speed given in TD 9/93 is 50kph, which Option 1 requires an absolute minimum sag K value of 9. Extrapolating the relationship between speed and minimum sag curve to a K value of 4.6 corresponds to a design speed of 40kph.

Section 4.14 of TD 9/93 states that relaxations to the absolute minimum K value may be made at the discretion of the designer and that 2 steps below the absolute minimum is acceptable for low speed single carriageway roads. The K value of 4.6 specified above is one step below the minimum quoted in line with this advice, two steps below correlates to a K value of 3.3

Option 2 uses a K value of 3.3. This corresponds to a design speed of 35kph (Table 1 page 7). This compromises the ride comfort but because the profile is in sag, with road lowering and bridge lifting the benefit is an improved safety factor through improved visibility.

TD 27/05 (Cross-Section and Headroom's) states that compensation for Vertical Sag Curvature and Deflection is required, however this standard refers to Motorways and Highway Agency

carriageways of vertical curvature greater than R1000 and is not applicable to Botley Road due to being classified as below the design speeds referred to in TD 9/93.

Vertical Curvature

(extract from Table 3, DMRB, Chapter 6, Section 1) (extrapolated using extrapolation formula)

Design Speed (KPH)	120	100	85	70	60	50	40	35	30	25	20
Absolute min sag K value (from DMRB)	37	26	20	13	9	6.5					
Absolute min sag K value (extrapolated)							4.6	3.3	2.3	1.6	1

Table 5 Botley Road Vertical Curvature Parameters

3.2.7 Highway Drainage

The existing highway drainage falls to a sump underneath the bridge with electric pumps carrying the water to an outfall. This may have to be reconstructed at a lower level if the road were lowered. The location of the electric pumps for ease maintenance would ideally be situated outside the carriageway envelope. Consideration should be given to utilising existing drainage pipe runs in any future development

For the permanent exclusion of water and as a foundation under the road it is proposed to put a permanent concrete under road slab in place. This will form the permanent foundation for the structure. Temporary pumping of the road will be required as at this stage the existing sump will no longer be functional.

Once the under-road slab and control for permanent ground water have been completed the surface water pumping system will need to be sized to meet the increased catchment area as a result of the widening, prior to the road surfacing being installed.

3.2.8 Consideration for buried services

Widening and re-alignment of the carriageway from the northern abutment encroaches on the existing raised footpath on the south side and any associated Statutory Undertakers equipment situated underneath will need relocating/lowering and possible diversions, also agreements/permits will need to be acquired.

3.2.9 Recommendation

The recommendation is that Option 2 is progressed to detailed design. This decision is based on safety foremost, and safety is measured through visibility.

Option 2 replaces the sag curve with a straight running under the bridge at a level gradient. This presents benefits in terms of reduced depth of excavation and improved visibility both looking in the direction towards to bridge and to the junctions. The lowest point of this option would be circa 53.600 AOD as opposed to 53.268 AOD utilising a sag curve. NB: as consequence of a level grade drainage units at the channels under the bridge will be required, rather than a traditional kerb and gully system.

This option requires gradients above the desirable 6% but below 10% to avoid impacting on the junctions, agreement has been reached following a meeting between TATA and Oxfordshire Council to use a maximum gradient of 10% if required, additional measures for skid resistance in the form of proprietary surfacing, and placement of salt bins may be needed. It is likely Oxford Council will have a preference for what they would like to see happen in this area, and further discussion with the council will need to continue take place to ensure all parties concerned are in unison with this option.

Based on forward visibility of a double decker bus looking through the bridge the proposal is an improvement on existing in both directions being above the desirable 70m visibility criteria by (Eastbound) 7.85m & (Westbound) 3.5m, Visibility towards the junctions for cars has been tested within the restricted limits of the survey for Botley Road, and doesn't account for any vertical profiling after the tie in. On the east this is not an issue as this is a controlled junction with stop start manoeuvres. Full visibility is achieved with the object set at the tie-in.

Although Option 2 has the lower sag curve which means rideabilty is reduced, it has no impact on safety because full visibility is maintained.

On a final note both options have worse (steeper) gradients 10% which we feel compromises the safety with regards HGV's stopping distances under breaking, being reduced. It may be that following a Road Safety Audit, Network Rail & the Councils will be able to determine whether additional safety measures should be proposed.

A review of the long sections for Option 1 and Option 2 can be found in Appendix A2: Botley Road Sketch W1002B-TTS-SKE-EHW-703001 Vertical Profile Indications.

Please note: for comparison the existing profile is taken about the centreline of botley road, however the proposed alignment crown line has shifted south away from the existing centreline due to the widening

3.3 Botley Road Pumping Station

Botley Road Pumping Station is located to the south of the station, within the embankment adjoining Botley Road. Access to the compound is via a locked gate below the footbridge over Botley Road.

Within the compound there is a small electrical room which houses an electrical sub meter, a Merlin Gerin distribution board and a 2 pump control panel. The electrical supply to this room is taken from the GEC MiniFORM panel located in the Main Station LV Switch Room.

Figure 16 Pump Station Control Panel

The supply cable route runs from the switch room to Platform 1 via the Main Station Mezzanine Level primary distribution route, then drops to below ground and runs below Platform 1 to the Pumping Station.

The Pumping Station comprises of 2no. deep chambers containing pumps. The chambers are accessed from the compound via lift up double chamber covers and there is an access ladder built into each chamber.

Figure 17 Pump Station Chamber

It is anticipated that due to the civils & highways alterations to the road lowering element of works that the duty of the existing pumps may require increasing. The depths of each pump station chamber may require increasing to accommodate the alterations in the road level and modification to the sump chamber which is located beneath the highway itself.

This shall be investigated at the next design stage and the exact make, model & duty of the existing pumps shall be checked for suitability. It is not anticipated that any modifications will be required to the distribution & control equipment contained within the Pumping Station Electrical Room.

4 Sheepwash Bridge Rail and Highway Works

This chapter outlines the single option selection and associated design constraints for modifications required to side of line section of structure DCL 63 48, Sheepwash River Bridge.

Underbridge DCL 63 48 is one of the structures under consideration. The structure currently carries 4 tracks of the Didcot to Chester mainline, the two track Dock Sidings, a public road and a footpath/cycleway over the Castle Mill Stream watercourse immediately north of Oxford Station. As part of the wider Oxford Corridor project, Network Rail has aspirations to install an additional track across the Castle Mill Stream watercourse which would serve a proposed new Down Island platform along the west edge of the existing station.

4.1 Bridges

4.1.1 Bridge Information

Underbridge DCL 63 48 comprises five structurally independent side by side bridge decks. The decks are numbered 1 to 5 from upside to downside and span the Castle Mill Stream immediately north of Oxford station.

Deck 1 is a single span metallic half through structure circa 1919 which carries two converging ballasted, non electrified tracks of the Dock Sidings lines. Deck 1 is owned and maintained by Network Rail.

Deck 2 is a single span metallic half through structure circa 1967 which carries the Up Main and the Up Passenger Loop lines, two ballasted non electrified tracks. Deck 2 is owned and maintained by Network Rail.

Deck 3 is a two span metallic half through structure circa 1967 which carries the Down Main and Down Passenger Loop lines, two ballasted non electrified tracks. Deck 3 is owned and maintained by Network Rail

Deck 4 is a single span metallic half through structure circa 1907 which carries Roger Dudman Way, a public road. The structure currently provides the only means of vehicular/emergency access to a children's nursery and an Oxford University accommodation block to the north of the Castle Mill Stream watercourse. Deck 4 is a former rail deck believed to now be owned by a third party.

Deck 5 is a metallic deck type structure circa 1967 carrying a footway/cycleway and several currently unidentified services. Deck 5 is believed to be owned and maintained by a third party.

The substructures are of blue brick construction with sandstone bearing blocks to deck 1 and deck 4, while there are concrete cill units at the bearings of decks 2, 3 and 5.

The existing abutments are wider than the combined width of the existing superstructures, with additional width to the west. It is considered that the substructures may have been originally constructed with provision for further widening to serve historical sidings to the north west of the station.

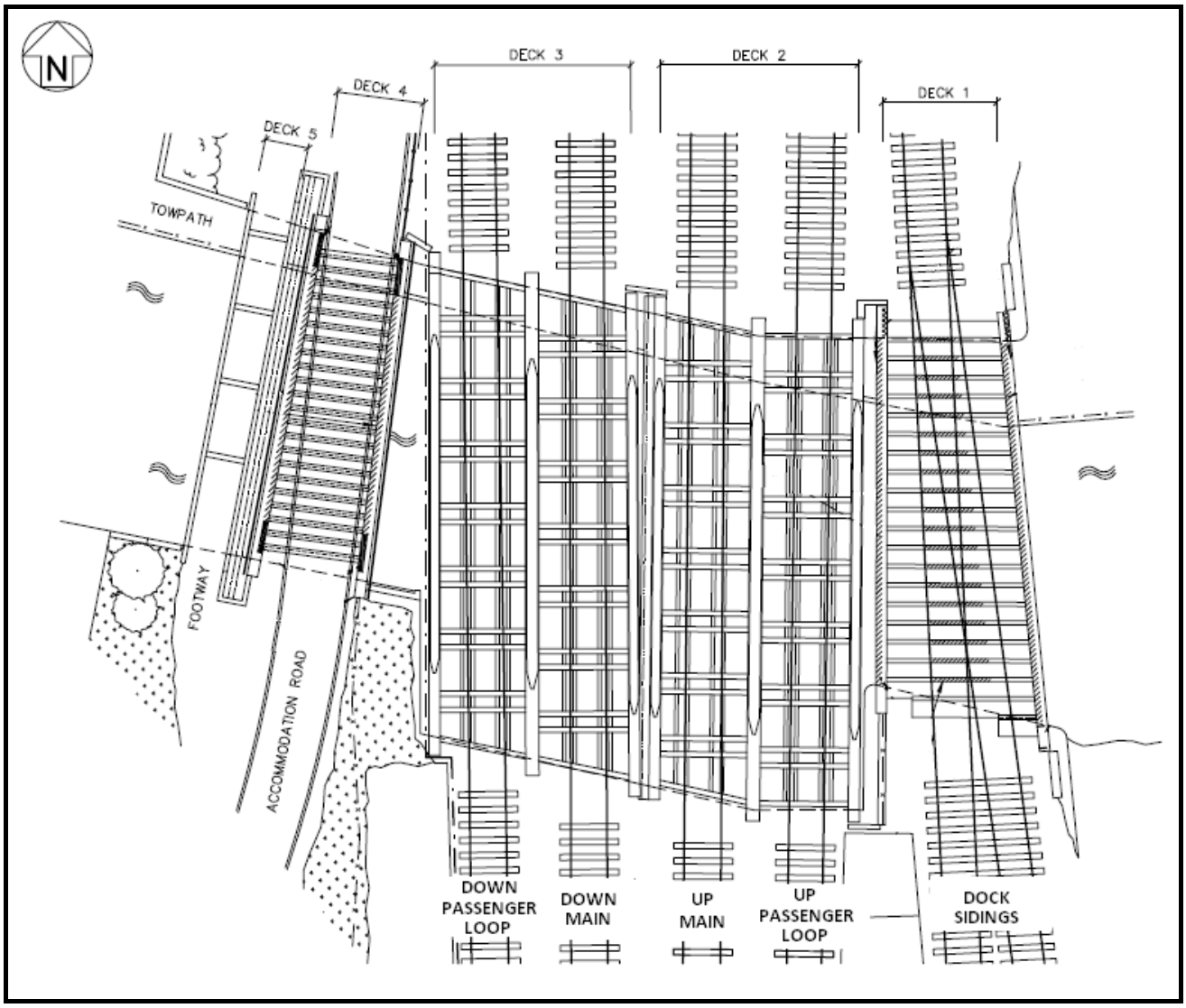

Figure 18 Plan on existing Sheepwash bridge crossing

4.1.2 Design constraints

4.1.2.1 Vehicular/emergency access

To the north west of Oxford Station, there is an Oxford University accommodation block and a children's nursery school. Deck 4 of Sheepwash bridge provides the only vehicular access to these buildings including emergency access for ambulance and fire crews. Throughout the course of the project, vehicular access to the north of the Castle Mill Stream must be maintained.

4.1.2.2 Existing services corridor

There is an existing services corridor in the space between deck 4 and deck 5 with a variety of cables and pipes carried by steel braces which span between the two decks. There are approximately 20 - 25 No. services including but not limited to 11kV electric cables, 50mm water pipeline, 100mm sewage pipeline, Vodaphone telecoms, BT telecoms and 180mm GTC gas pipeline. A desktop study of buried services and archive material has been carried out although not all services have been identified at this time.

There are also 6 no. service ducts carried beneath the existing footbridge (deck 5). It is currently unknown whether the ducts contain any services.

Figure 19 Sheepwash Bridge, Service corridor between deck 4 & deck 5 (left). Service ducts suspended below deck 5 (right)

1 No. 11kV high voltage electric cable and 2 No. 120mm^2 low voltage cables which are currently suspended across the width of the south abutment will be removed as part of the Phase 1 Oxford Corridor works. There are another 5No. unidentified cables suspended from the south abutment (see figure 20). Reconstruction of the existing road (deck 4) will require these additional services to be identified and redirected or removed if redundant. There is a 33kV

power cable buried beneath the tow path at the north side of the bridge, this will need to be protected during construction works.

Figure 20 Sheepwash Bridge, cables suspended across the width of the south abutment.

4.1.2.3 Track considerations

Sheepwash bridge is required to carry a new ballasted overhead electrified track with a proposed line speed of 50mph.

In order for the proposed new track to serve island platform 5 and remain within the existing boundary to the west of the existing station, at the south abutment of Sheepwash bridge, the perpendicular distance from the west boundary to the cess rail running edge must be 9.6m as recorded on Tata P-way drawing B90505B-DRG-PWY3022 (see Appendix A).

The alignment of the existing road bridge (deck 4), which was originally a rail bridge, is not able to meet the constraints of the proposed track alignment as set out above. Lifting and realigning the road deck, in order to re-purpose it as a rail deck would increase the skew of the main girders and would lengthen the span such that the deck would not fit in the space without

significant modifications. This is not deemed to be a feasible option given the age and condition of the deck.

The proposed track alignment is on a transition on to an S&C unit but is laid with 0 cant. Based on track RAM comments for the Botley Road bridge option there is scope to use reduced depth ballast and shallow depth sleepers to ensure that limited headroom to the underside of Sheepwash Bridge is not compromised when constructing the new deck 4 and provide co planer tracks into the throat of the station.

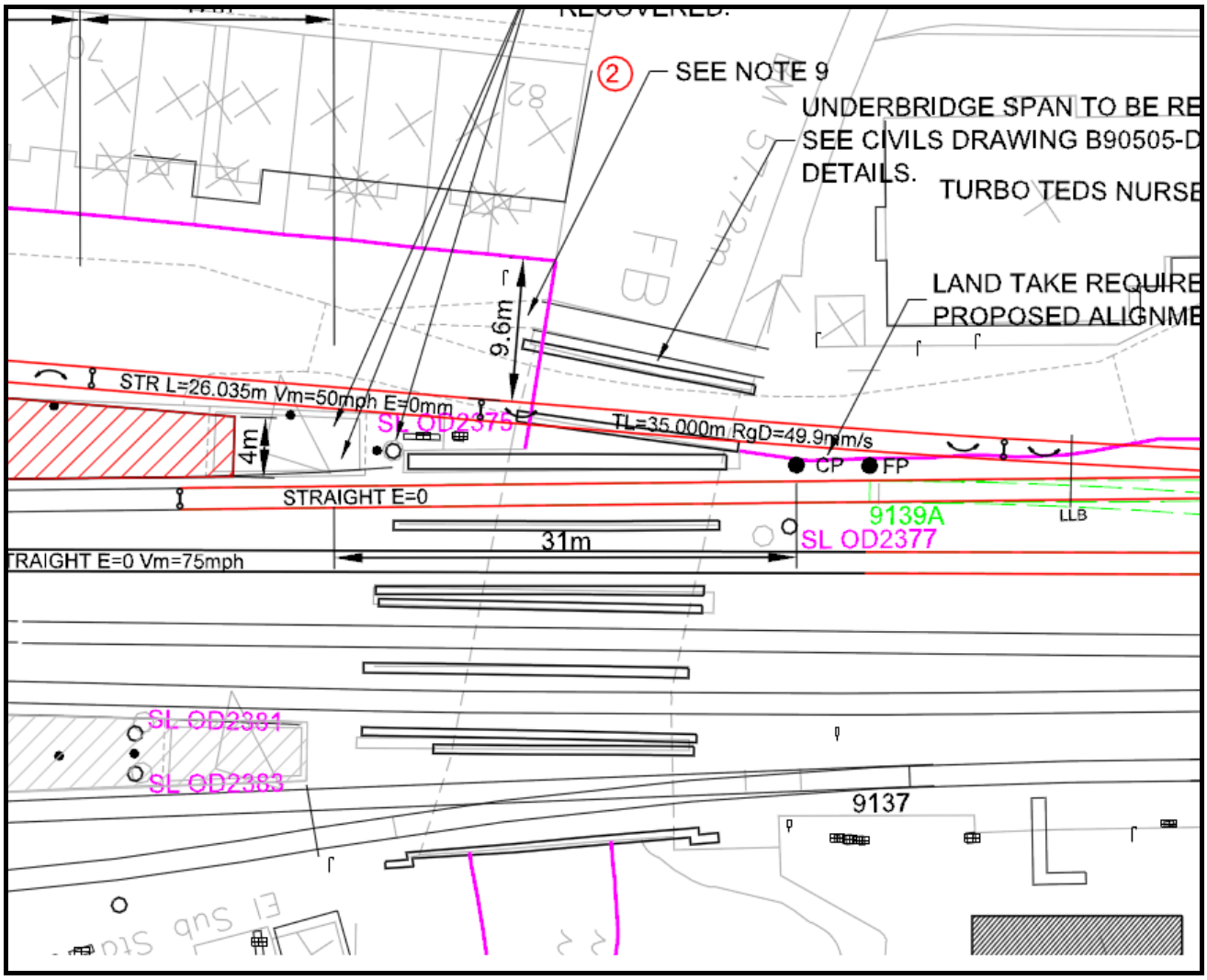

Figure 21 Extract from Tata P-way drawing B90505B-DRG-PWY3022

4.1.2.4 OLE considerations

The proposed new Down Island Platform line is to be an overhead electrified track. Due consideration will need to be taken of the separation of pedestrians, road vehicles and railway personnel from overhead line equipment.

Given than the span of the structure is approximately 14m, the OLE will span between masts either side without the need to fix supports to the underbridge.

Great Western Electrification project aims to have electrified the Down Passenger Loop, Down Main, Up Main and Up Passenger Loop lines by the end of 2016. As such, Phase 2 Oxford Corridor construction works at Sheepwash bridge will take place in close proximity to overhead electrification.

4.1.2.5 Restricted available width

The proposed new Platform 5 is to be located along the western edge of the existing station. In order to serve the new platform, the proposed new track will be required to cross the Castle Mill Stream watercourse to the west of existing deck 3. The western edge of the existing Network Rail boundary is defined by a retaining wall. The retaining wall forms the boundary between the railway and a line of private terrace housing. The houses are on a lower level to the railway, each with a small rear garden between the retaining wall and the property. The retaining wall forms the limit of any development to the west of the existing bridge deck 5 without the requirement to acquire additional land.

If vehicular access is to be maintained at the Sheepwash crossing in the long term, the existing road alignment will need to be moved to the west in order to create room for the proposed new Down Island Platform Line. There is some scope for this at the south west corner of the structure, however at the north west corner of the structure there is a Nursery School building which will prevent sufficient realignment of the road. Maintaining the vehicular crossing at the Sheepwash will require the acquisition of a portion of the land which is currently occupied by the Nursery. This acquisition is likely to compromise the Nursery building itself (see Section 5.2). An alternative would be to provide access to the area north of Castle Mill Stream from another location.

4.1.2.6 Watercourse & towpath clearances

Construction depth of any proposed reconstruction at the existing Sheepwash crossing will be limited by the existing available headroom to the underside.

The existing headroom to the towpath beneath the existing structure is low at approximately 1900mm. The towpath is used extensively by pedestrians and cyclists and there are warning chevrons painted on the deck steelwork to warn users of the low headroom.

At the time of the TSP inspection in August 2014, the headroom to the watercourse was approximately 2500mm. The watercourse is navigable, forming a link between the River Thames and the Oxford Canal. The water level varies significantly and signs along the towpath warn of potential flooding.

4.1.2.7 Interfaces with planned renewals or other projects

The Great Western Electrification project is currently proposing to install overhead electrification to the existing decks 2 & 3 by the end of 2016.

4.1.2.8 Access

Two methods were considered for this study, the assumption was that both pedestrian and vehicle access have to be maintained to the buildings to the north of Castle Mill Stream.

The first option is to build the new decks 4 & 5 at Sheepwash bridge while maintaining traffic (however infrequent) somewhere near the existing abutment line on either the existing bridge or the part complete new bridge. A possible pedestrian diversionary route exists to the west of the existing structure, along Cripley Road, Abbey Road and over an existing footbridge on to the towpath to the north of Castle Mill Stream (see figure 22). It would be considered that the safest option is to divert pedestrian traffic away from the bridge site if possible. Part of the new widened structure could then be built on the west side and sufficiently wide to accommodate a single lane of traffic. However, construction would be undertaken in close proximity to the existing trafficked route. Traffic would then have to be switched on to the new span, isolating the remaining new bridge construction to the area between the new trafficked western deck and the railway, limiting scope for access and potentially increasing possession requirements for working adjacent to the railway.

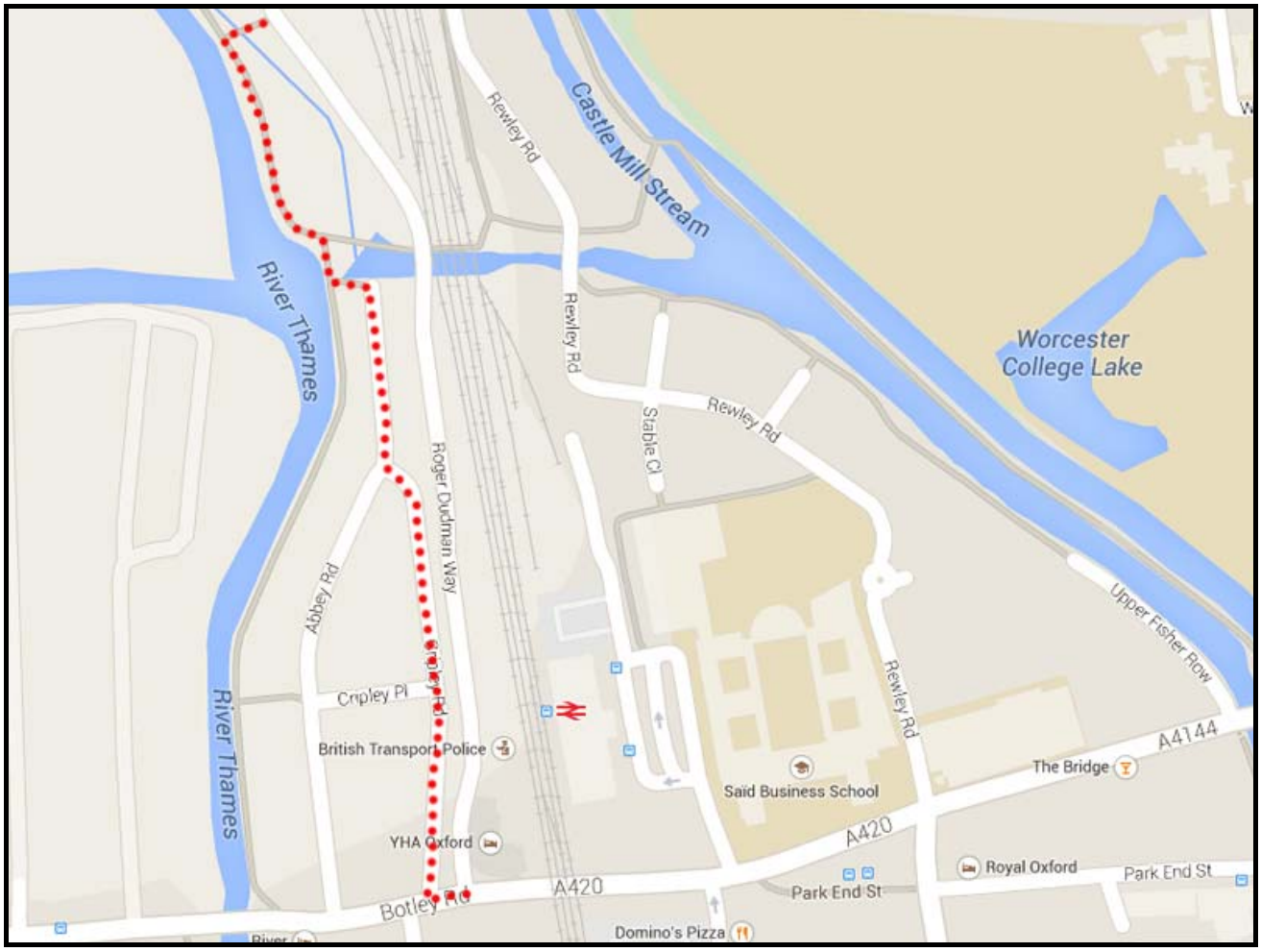

Figure 22 Possible pedestrian diversion using Cripley Rd, Abbey Rd and the Castle Mill Stream towpath

An alternative access arrangement avoiding the clash between the works and public vehicular traffic, would be to provide temporary access from the north of the site in conjunction with the pedestrian diversion illustrated in figure 22. A vehicle route exists along Roger Dudman Way over the full extent of the student residence. Beyond the student accommodation a track exists heading northward toward Walton Well Rd, crossing Castle Mill Stream via an existing bridge. This route could be temporarily upgraded to provide vehicular access to the student accommodation while Sheepwash Bridge is reconstructed in an isolated worksite (see figure 23). The safest solution would be to segregate the work site at Sheepwash Bridge from the general public however, the Network Rail VeRA database currently lists the 3 span overbridge at Walton Well Rd as under strength and it may require strengthening/reconstructing in order to provide full vehicular access. Temporary strengthening of the bridge crossing at Castle Mill Stream would be required and could be achieved using a Mabey Quickbridge solution. In terms of economy, although the bridge strengthening works may seem a high investment, it could have the effect of reducing the overall construction duration and may be less disruptive to the railway throughout the project.

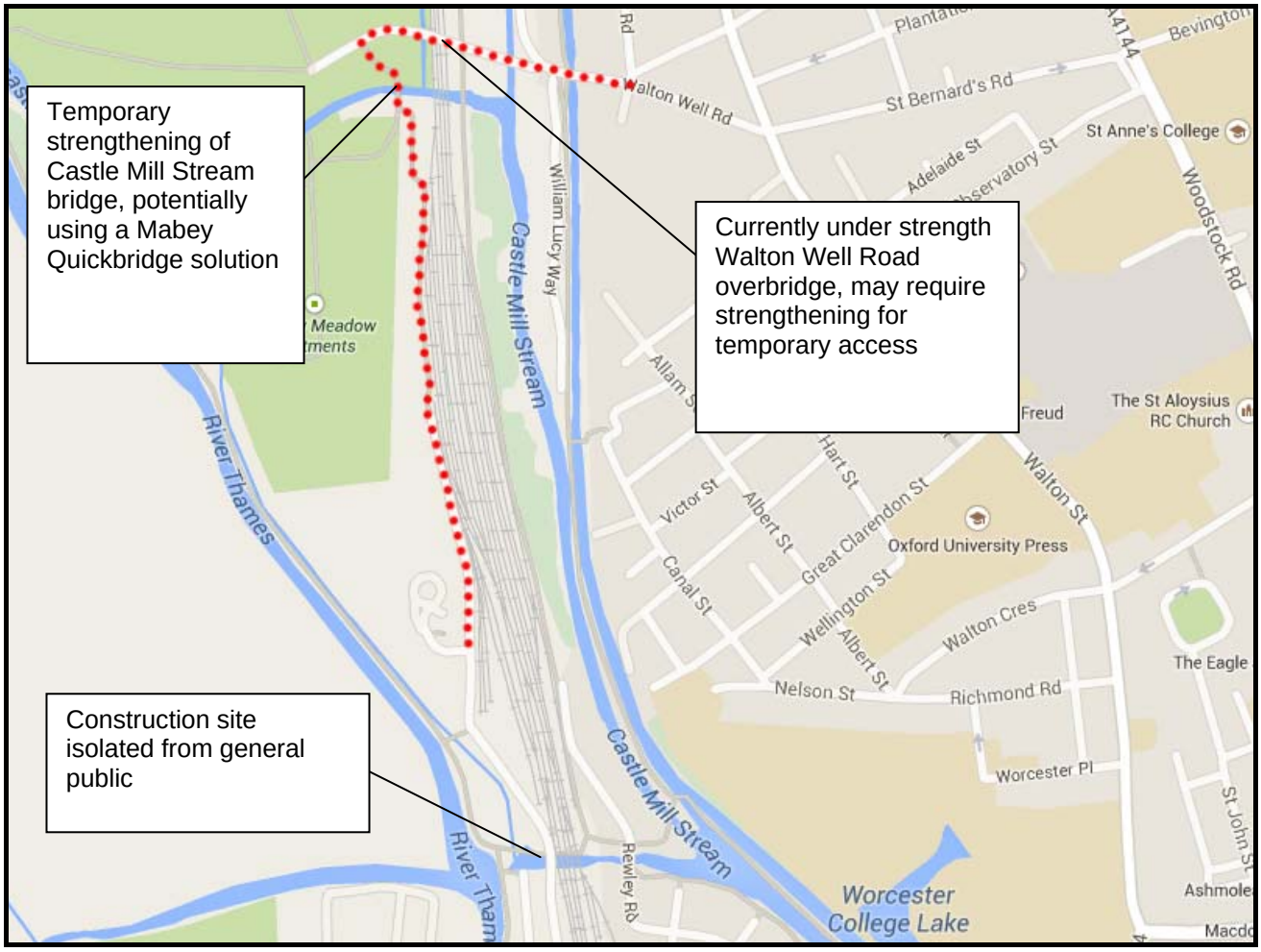

Figure 23 Possible vehicular diversion using Walton Well Rd

4.1.3 Recommended single option selection

It is recommended that reconstruction of the existing third party decks 4 & 5 is the option taken forward to approval in principle as this option can provide all aspirations without the need to acquire additional land to the south west of the structure while maintaining vehicular access to the north of Castle Mill Stream at the existing crossing throughout the project. Replacing the existing road span with a new NR standard design U-deck underbridge would allow installation of a new down island platform line on the required alignment and also provide a maintenance walkway, removing current limited clearance at Sheepwash Bridge on the down side of the existing tracks. Constructing a steel/concrete composite deck type structure in place of the existing footbridge would allow installation of a 2m wide footpath/cycleway and a single lane carriageway. Existing services would need to be temporarily suspended from above to allow demolition of the existing decks 4 and 5, then relocated to the underside of the new composite deck type structure. Identifying services affected is a critical task at design for approval in principle. It is envisaged that reconstruction of decks 4 and 5 could retain and reuse the existing substructures with the addition of new concrete cill units. An outline construction sequence is envisaged as below.

- Temporarily support existing services corridor from above.

- Remove existing footbridge (deck 5), temporarily redirecting pedestrians along Abbey Road and over the existing footbridge to the west of Sheepwash bridge (see figure 22).
- Break out existing abutments and prepare new bearing shelf for new deck 5.
- Construct a steel/concrete composite deck type structure from the western limit of the south abutment up to the edge of the existing services corridor. Install a temporary road surface on this new structure and remove vehicular traffic from existing deck 4.
- Relocate some of the services in the existing services corridor to the underside of the new composite deck, to provide enough vertical clearance to extend the composite deck eastwards over the remaining services.
- Remove existing deck 4 and replace with a standard Network Rail U-Deck structure, aligned for proposed new track to service proposed island platform 5.
- Extend steel/concrete composite structure eastwards towards new U deck.
- Install maintenance walkway to west elevation of new U Deck.
- Install footway/cycleway to west side of new composite deck and minimum 3m wide single carriageway to remaining portion of composite deck.

The new road alignment will require the acquisition of a portion of the land to the North West of the structure, where The Cooperative Day Nursery is currently located.

Figures 24 to 27 below illustrate the proposed changes to decks 4 and 5 based on available survey information.

An alternative option of providing a new permanent access from the North at Walton Well Road (similar to that described in section 3.9.1 as a temporary arrangement) would require the reconstruction of the currently under strength, 3 span overbridge DCL 64 08 Walton Well Road in order to provide access to the west of the DCL lines. A further reconstruction of the existing structure over the Castle Mill stream would be required which would provide permanent access from Walton Well Road to a footpath/cycleway North of the existing University accommodation buildings. This footpath/cycleway would need to be widened and would run south, parallel to the newly electrified DCL main lines. The existing Sheepwash road bridge (deck 4) would need to be reconstructed in order to provide the required track alignment for the proposed new platform 5 track. There would be no road vehicle crossing provided at Sheepwash in the long term under this option. The existing services corridor would remain untouched and the cost and time involved in diverting the existing services would be mitigated under this option. There would also be no need to acquire land from the Nursery School to the north west of Sheepwash as the road alignment between Sheepwash bridge and the University accommodation blocks could remain as existing.

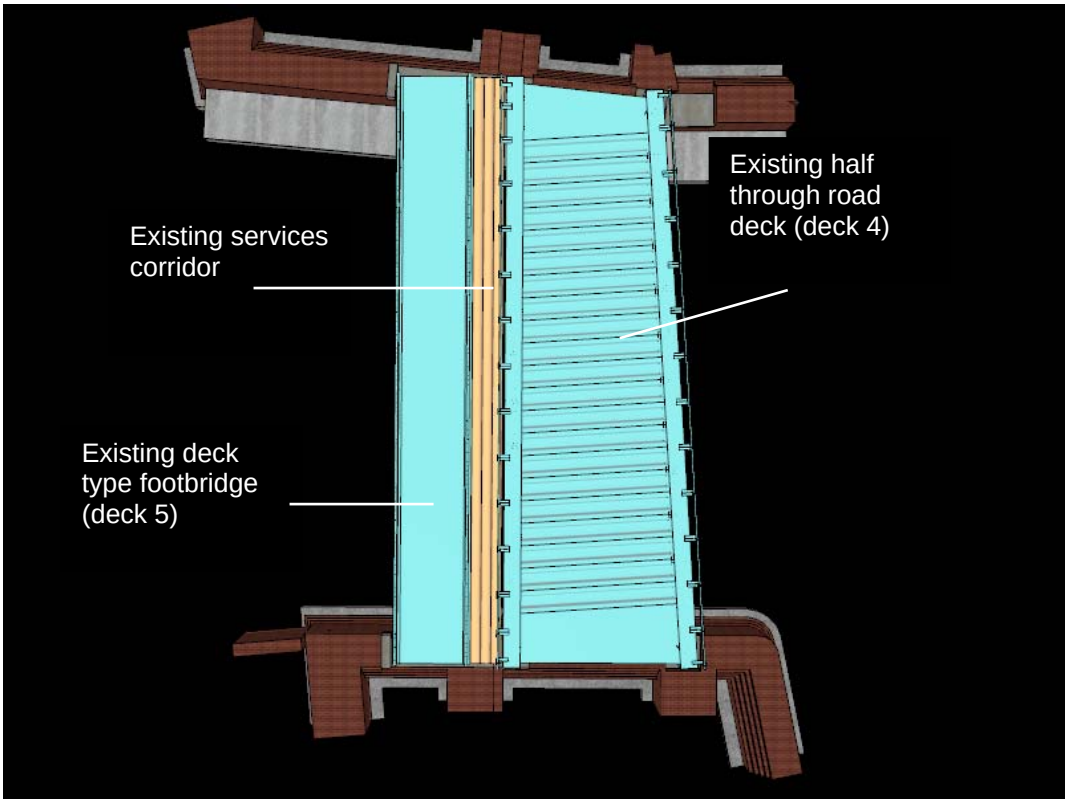

Figure 24 Sheepwash Bridge, plan on existing decks 4 and 5

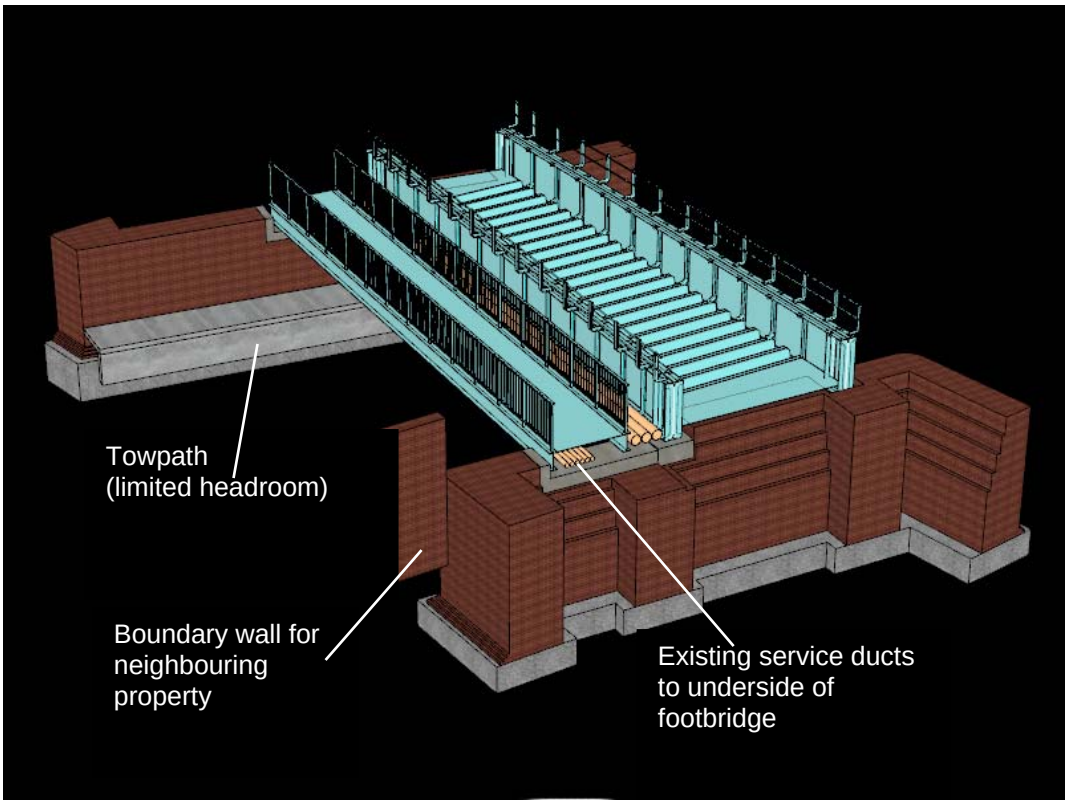

Figure 25 Sheepwash Bridge, isometric view on existing decks 4 and 5

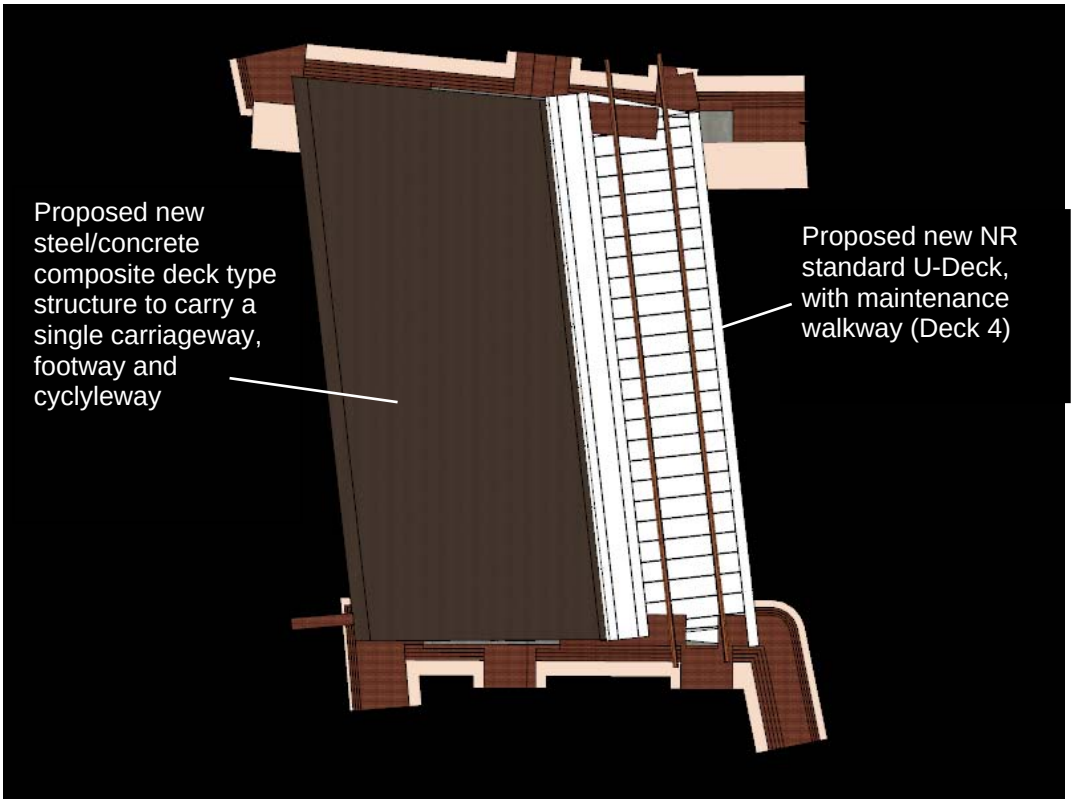

Figure 26 Sheepwash Bridge, plan on proposed decks 4 and 5

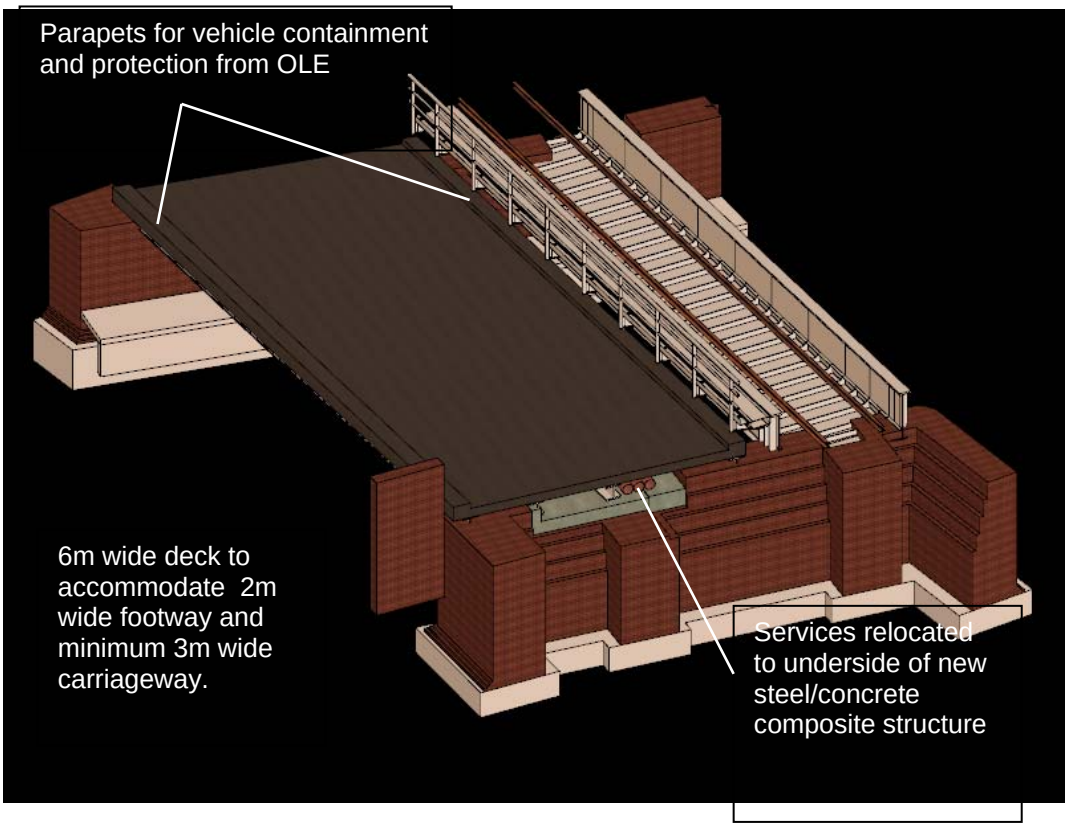

Figure 27 Sheepwash Bridge, isometric view on proposed decks 4 and 5

5 Relocation of 3rd Party Property

The area associated within the scope of Phase 2 consists of various railway and non-railway buildings all accessed from Roger Dudman Way. There are 2no. non-railway structures affected by the proposed introduction of platform 5:

- • 199No.bed Youth Hostel (yellow circle)
- • Turbo Teds / Co Operative Children's Nursery (blue oval)

The Google Map extract below highlights the existing site and buildings contained within Phase 2 of the scheme.

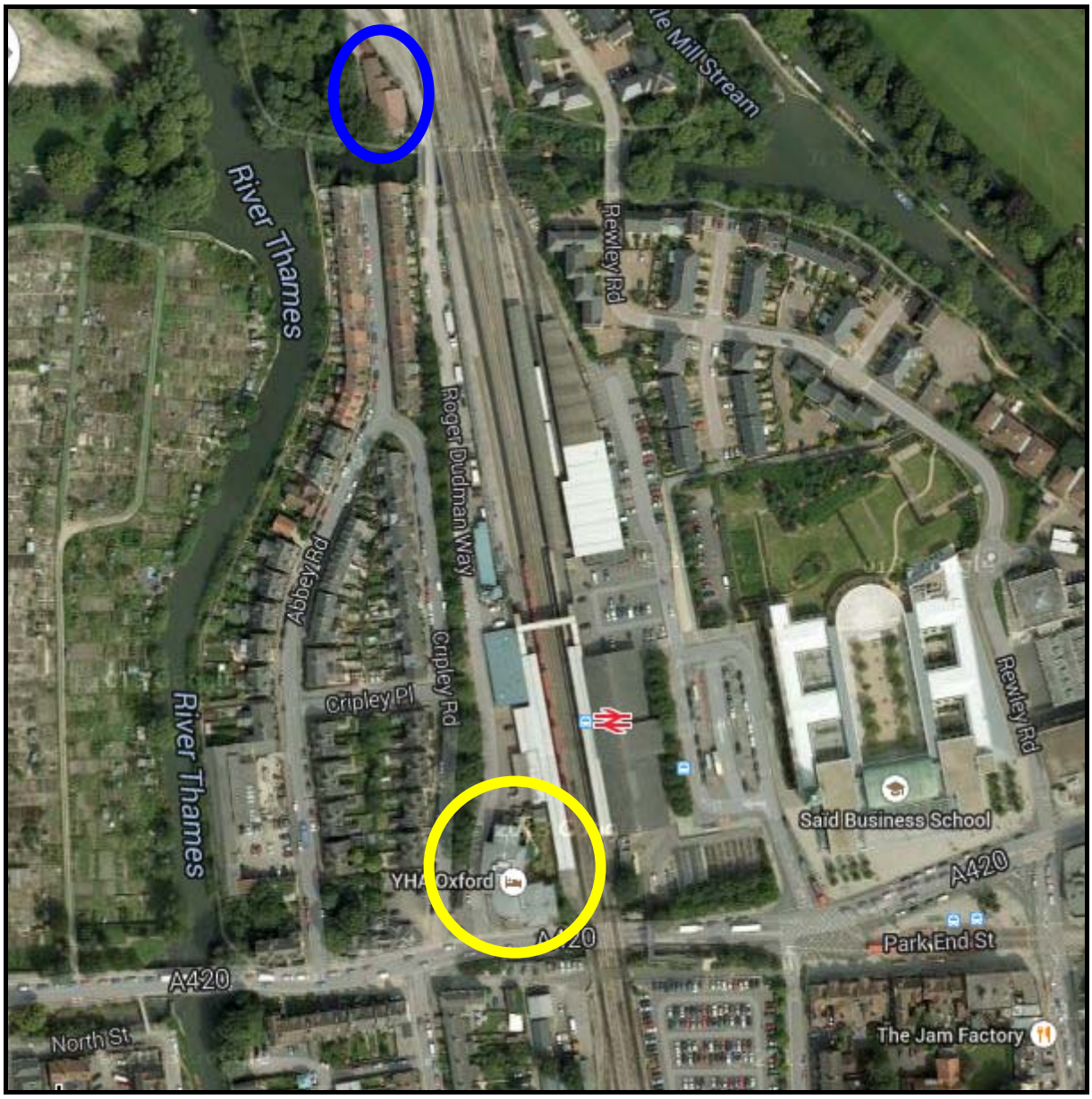

Figure 28 Google Maps extract of Phase 2 buildings

The proposed scheme results in the need to remove both of these facilities to enable a new track and a new platform 5 to be introduced and relocate ideally within available Network Rail land.

5.1 YHA Oxford – Youth Hostel

5.1.1 Existing Provision

To the south of the Phase 2 zone at the junction of Roger Dudman Way and Botley Road is a 199No. bed youth hostel over four storeys and constructed using traditional masonry methods. This building forms a prominent landmark on this open public facing corner of the site, accommodating the considerable local topography change within its design in particular at the aspect facing Botley Road and the associated railway bridge.

Figure 29 Existing site plan of Youth Hostel

5.1.2 Proposal

As mentioned there is a limited space available to accommodate a facility of the same or similar capacity as the existing which remains in the vicinity of the railway station which provides, one would assume, the hostels main source of clientele

One of the first activities within the Phase 2 programme would be to construct this new Youth Hostel which would allow the current activities to continue with minimal disruption. The proposal

is to site a replacement hostel on the area of land at the southern extent of the up sidings allowing the proposed DNO cabinet to be located as required. It has been noted within TSP Geotechnical report **W1002B-TTS-MEM-EGE-007001** that there is a considerable extent of contamination on the proposed site. This shall need considerable remediation to address especially when considering its proximity to the local watercourses primarily to the west.

Advantages:

- Close proximity to the station
- Sited on Network Rail land
- Utilising and remediating currently contaminated land

Disadvantages:

- Close proximity to track which is proposed to be electrified
- None prominent location especially when compared to its existing site

The extract below indicates a proposed location for the new Youth Hostel and its relationship to the DNO cabinet and sidings. Currently it is considered that this could be a modular construction which maximises offsite fabrication and vastly reduces onsite activities. This could then be clad on site to present an aesthetically pleasing appearance to satisfy all parties.

Figure 30 Youth Hostel relocation to South end of Down Engineering Sidings

5.2 The Co-operative Childcare Nursery (Turbo Teds)

5.2.1 Existing Provision

To the north of the Phase 2 zone beyond Sheepwash Bridge prior to reaching the university student accommodation, the children's day nursery operates on a site opposite the up sidings. The single storey building is primarily traditional masonry construction with associated private external playground areas within the confines of a timber close boarded fence.

The extract below shows the current location of the nursery and its interaction with the existing provision for Sheepwash Bridge and the adjacent sidings

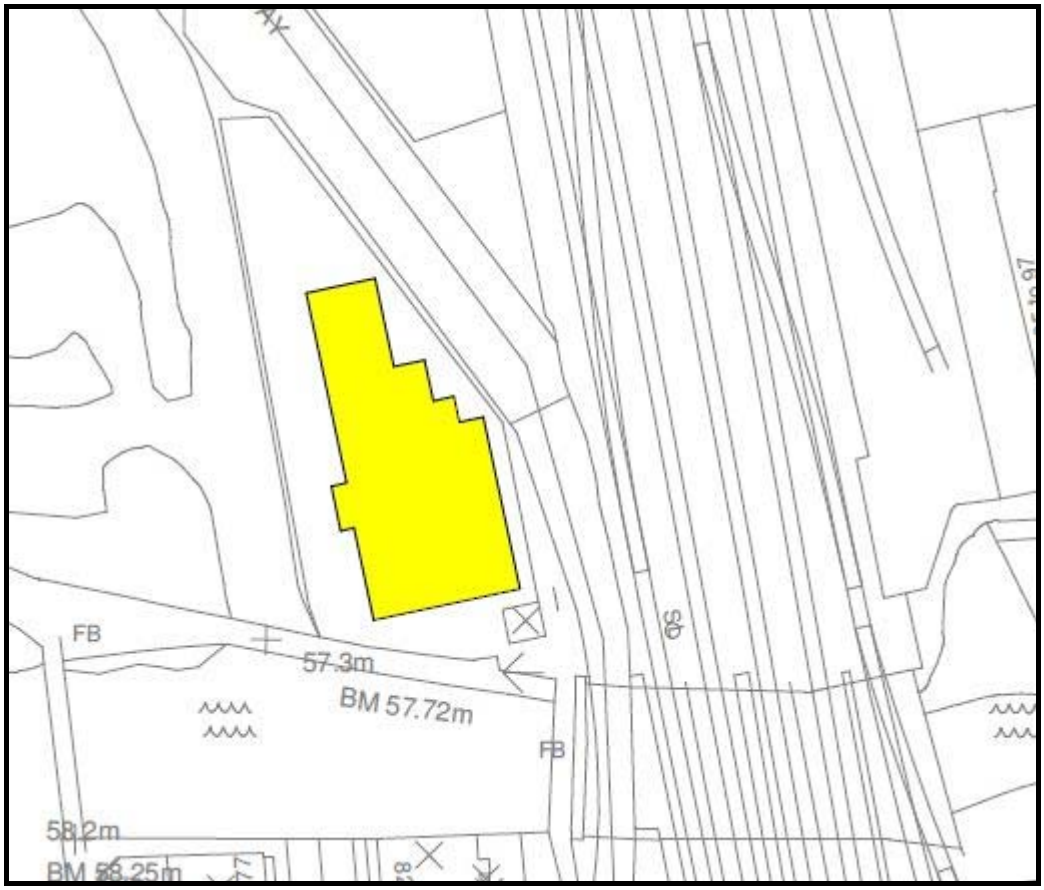

Figure 31 Existing site plan of Turbo Ted's Nursery

5.2.2 Proposal

The proposal is to provide a new nursery building to the south of Becket Street car park to enable the current operations to continue and to afford minimal disruption. This proposed building is thought to be a modular construction which maximises offsite fabrication and vastly

reduces onsite activities. This could then be clad on site to present an aesthetically pleasing appearance to satisfy all parties. This new area would be located to best suit other elements within the southern aspect of the car park and take into account the proposed ramp access to the existing footbridge.

Once the new nursery is constructed and occupied / operational then the existing building can be demolished to provide a site compound area from which to construct / install the new Sheepwash Bridge. The proposed track alignment results in the need to realign Rodger Dudman Way which in turn requires the eastern extent of the existing nursery site to be obtained to accommodate it.

Once the new Sheepwash Bridge is constructed and complete the intention would be to relocate the nursery back on its former site (albeit a slightly narrower site). Due to the site reduction the intention would be install a 2 storey nursery building providing the same area as the former but over two floors with the introduction of vertical means of access. The intention would be to design both the single storey temporary building so that it can be dismantled and re-erected on the former site as a 2 storey building, although this shall depend upon timescales and other factors which are currently unknown.

Advantages:

- Original location retains its close proximity to the station
- Sited on nursery owned land which reduces the impact on any required acquisitions

Disadvantages:

- Relocation is required (but on a temporary basis)
- Reduced site footprint resulting in 2 storeys and introduction of vertical circulation

The extract below shows the proposed temporary location for the nursery to the southern extent of Becket Street car park.

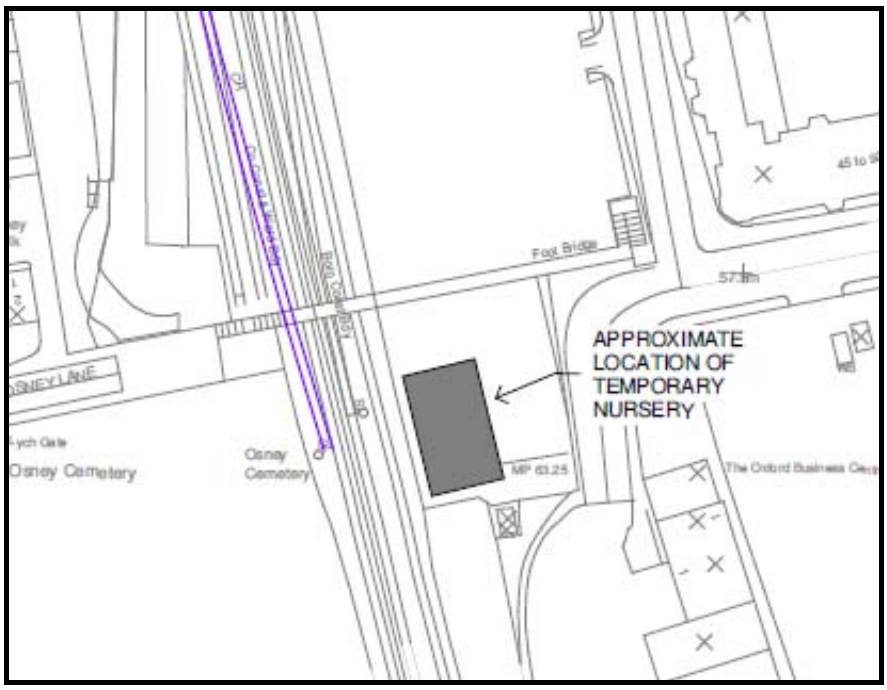

Figure 32 Proposed temporary relocation of Nursery

The extract below shows the proposed new location of the nursery on a narrower site and its interaction with the new Sheepwash Bridge and the adjacent sidings and proposed new location with the Youth Hostel as covered within the previous section of this report

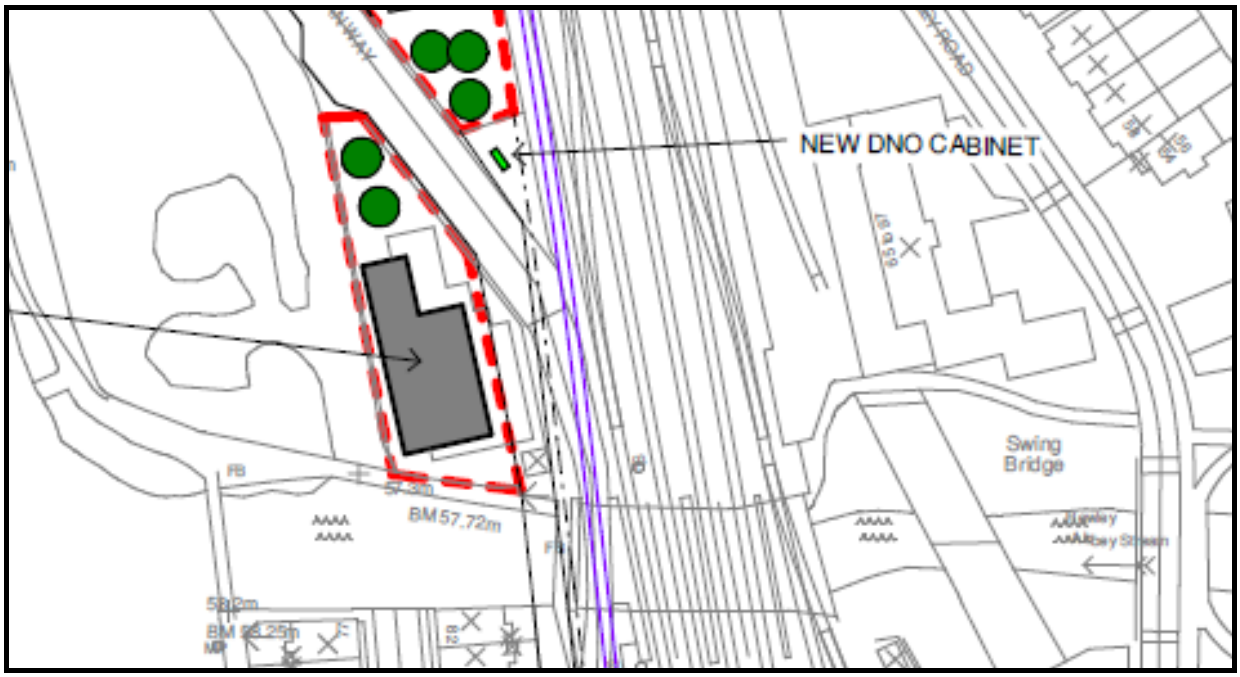

Figure 33 Nursery shown in permanent position relative to existing

6 Western Entrance Building

The additional Down through rail line and relocation of YHA Oxford, establishes an area to the West of the existing Station which would be suitable to create a new Entrance Building, offering twin aspect to serve a station which is anticipating uplift in its rail user numbers.

6.1 Buildings

The proposal is to provide a new single storey western entrance to the station accessed from Botley Road and Cripley Road utilising the site formally occupied by the Youth Hostel. The proposed station building shall form the focal point at the corner formally occupied by the Youth Hostel with the proposal to remove the entrance to Roger Dudman Way from Botley Road enabling a pedestrian zone and more user friendly space. To facilitate this, the proposal is also to remove the two existing small single storey buildings which are located on the island between Rodger Dudman Way and Cripley Road. The proposed layout provides the following accommodation:

- **Entrance lobby** access via 2No.set of automated double sliding doors and incorporating automated ticket machines
- **Concourse**
- **Ticket office** with 2No.sales locations and associated queuing area offset from the main concourse. This area also has a secure store room accessed to the south
- **Ticket office administration** with provision for 2No.members of staff
- **Staff toilet** providing accessible WC provision
- **Staff welfare** providing a small kitchenette with worktop, sink drainer, fridge – with seating assumed to be bar stools at the worktop rather than table and chairs
- **Customer toilets** providing single unisex accessible WC accessed from the main concourse. Male (1No.urinal / 1No.WC), Female (2No.WC)
- **Plant Room**
- **IT / Comms Room**
- **Switchroom / lift motor room**
- **3No.concession areas** with direct access from external
- **Staircase** accessed from the concourse area to Network Rail standards
- **Passenger lift** accessed from the concourse area to Network Rail standards
- **Passenger Subway** formed using precast concrete complete structure to minimise onsite activity, faced on site using a suitable robust material – presumed tiled - and designed to Network Rail standards. This shall be formed using a cut and cover approach and sequenced to allow full integration with the other planned activities for this area. Services shall be contained within a duct aligned with the subway at high level to allow simple integration with soffit fixed installations.

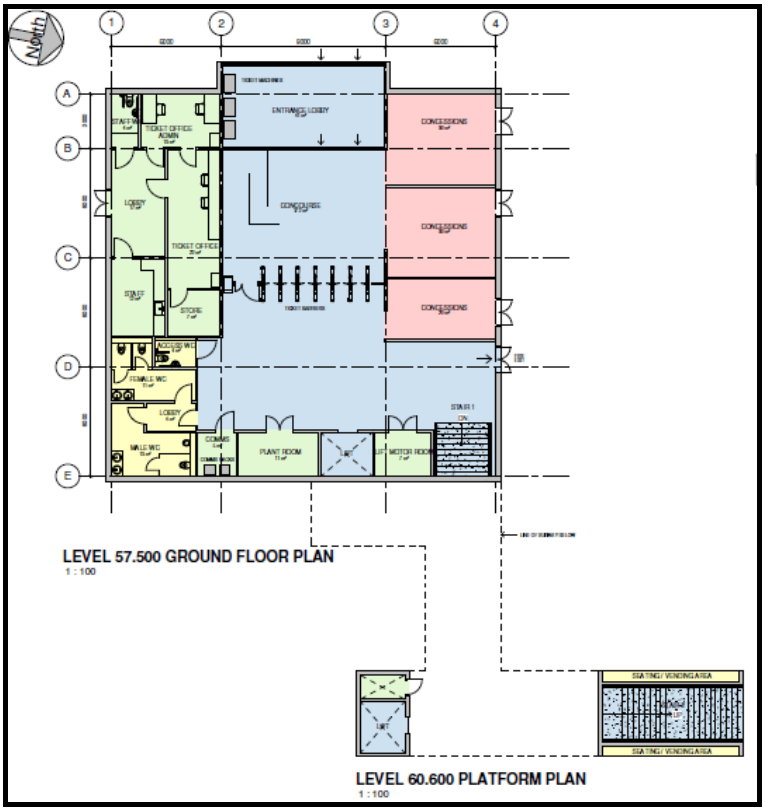

Figure 34 Western Entrance, Proposed Floor Plans – Pedestrian 'surface' level

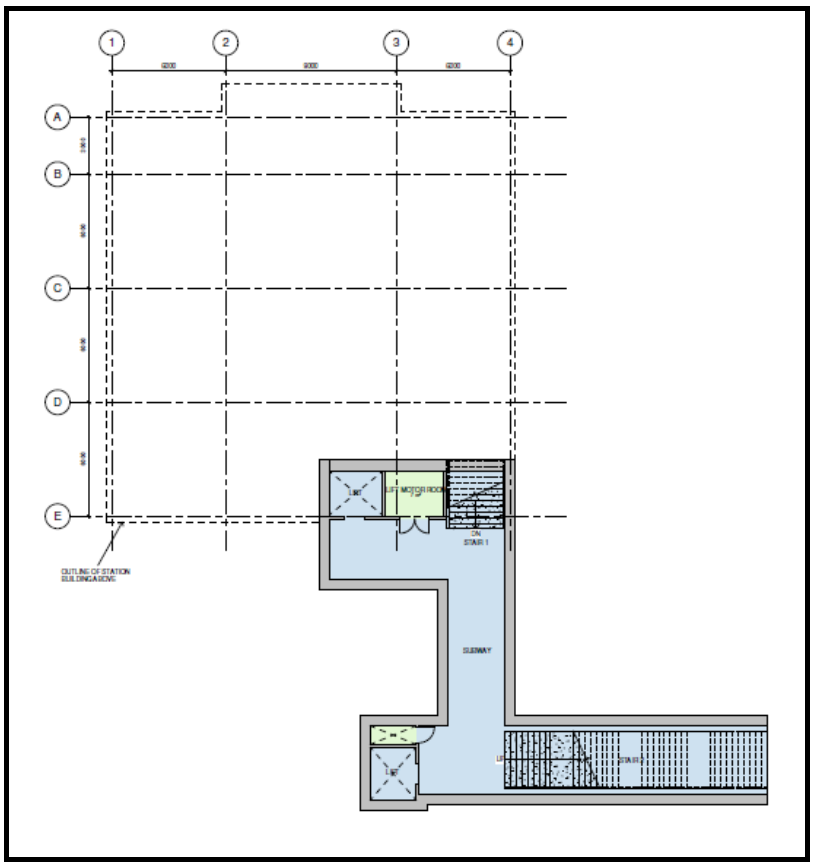

Figure 35 Western Entrance, Proposed Floor Plans – Pedestrian 'subway' level

6.1.1 Sections

The two section drawings below show the proposed relationship between the various elements within this phase of scheme

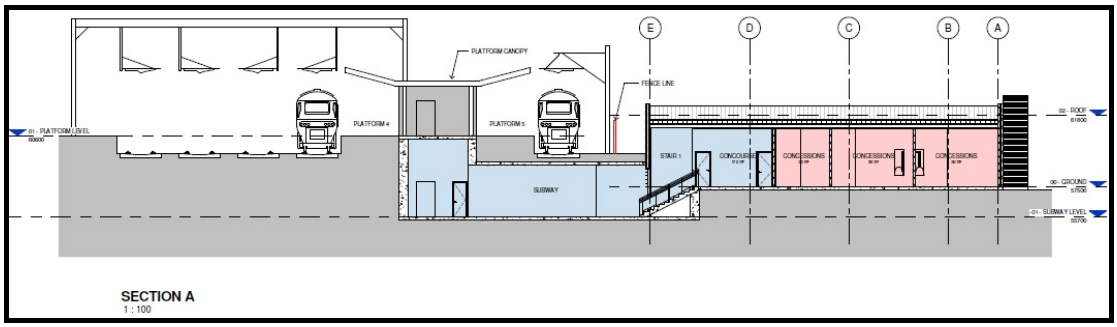

Figure 36 Western Entrance Cross section on Grid 4

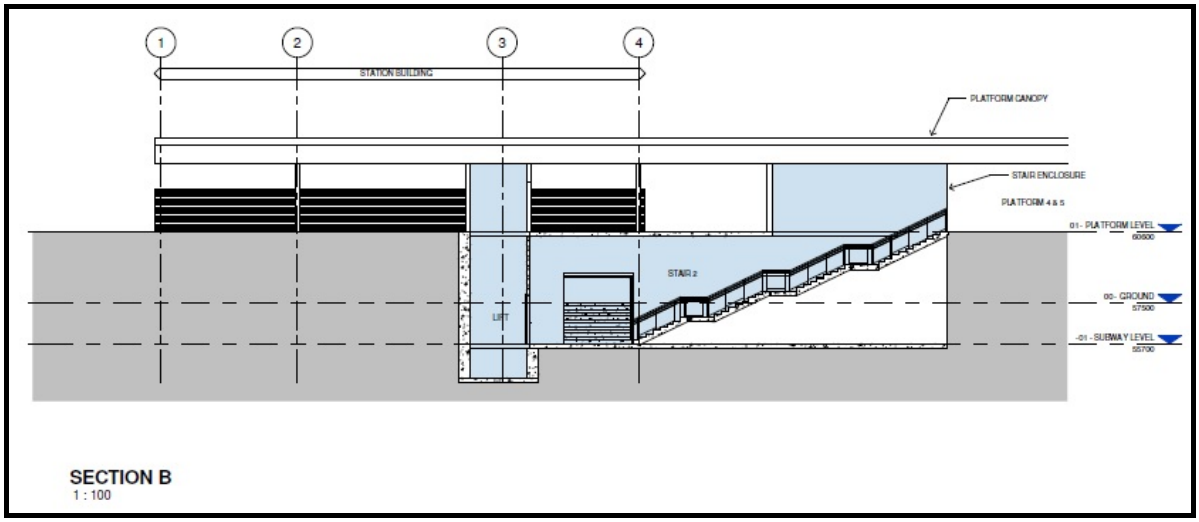

Figure 37 Western Entrance Long section through Platform 4/5

6.1.2 Vehicle Movements

Vehicle movements are car parking in and around this new western entrance are critical to the success of this scheme. With this in mind and to provide and enhance the public space and interaction with the entrance on this prominent location the decision was made to remove the entrance from Botley Road to Rodger Dudman Way. This means that there is a need to provide a new entrance from Cripley Road into the existing Rodger Dudman Way to maintain vehicle access to the Student accommodation and beyond. Local topography in this area offers quite severe level changes between these two road elements, while maintaining vehicle access to the student accommodation for at the least tender access at all times. To develop the vehicle access and car parking in this area, 2No.scheme proposals have been developed to enable discussion and option selection. For both options the removal of the Youth Hostel and the Rodger Dudman Way are constant, as is the introduction of the western entrance building on this prominent corner.

6.1.2.1 Option 1

- Roger Dudman Way shall be rebuilt and realigned from the new junction with Cripley Road to beyond the new bridge over Castle Mill Stream.
- The ground level adjacent to the station building and the new road junction will be excavated so the levels are similar to Cripley Road. Away from the station building & road junction the level differences between Cripley Road and Roger Dudman Way will be accommodated by introducing retaining walls and a ramp to the new road at a maximum gradient of 1 in 40.
- 3No.accessible parking bays will be provided adjacent to the station building.
- 20No.staff and short stay car parking bays will be provided directly off the new Roger Dudman Way.
- A taxi bay will be provided off Cripley Road to accommodate 3No.taxi’s.

- Sheltered cycle stands will be provided to accommodate 20No.bicycles.

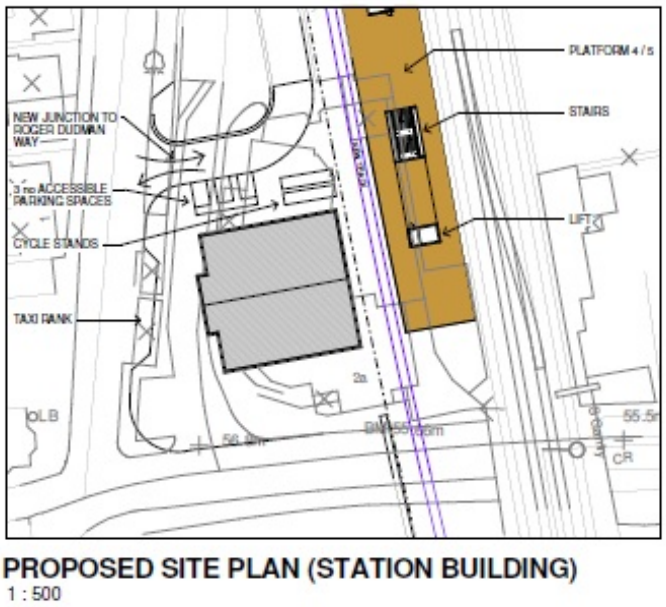

Figure 38 Western Entrance, Vehicle Circulation Option 1

6.1.2.2 Option 2

- The junction of Botley Road and Roger Dudman Way will be removed and a new junction will be provided from Cripley Road with a one way kiss and drop area to the north of the station building. A pedestrian space will be introduced to the front of the new station building.
- Any level differences between Cripley Road and Roger Dudman Way will be accommodated by introducing retaining walls and a ramp to the new road at a maximum gradient of 1 in 40.
- No accessible parking bays, short stay or staff parking will be provided adjacent to the station building. All these provisions will be provided to the existing station entrance area.
- A taxi bay will be provided off Cripley Road to accommodate 3No.taxi's.
- Sheltered cycle stands will be provided to accommodate 20No.bicycles.

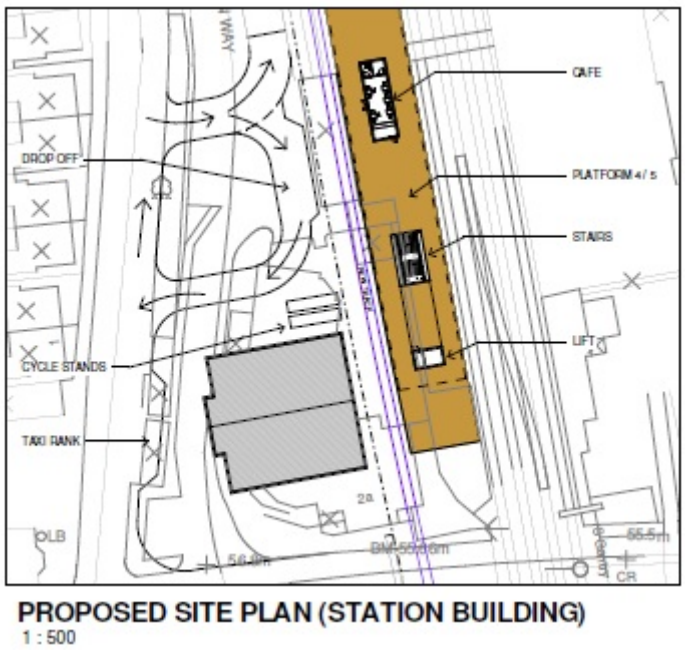

Figure 39 Western Entrance, Vehicle Circulation Option 2

6.1.3 Phasing

An indication of a proposed phasing plan for this has been developed and shall be embellished through the next design stages. To summarise current understanding:

- Build new Youth Hostel in sidings area.
- Build new temporary nursery in Botley Road car park
- Relocate people to Phase 1 TOC building.
- Demolish existing buildings including YHA & Nursery. Retaining access to Roger Dudman Way.
- Install new access & ramp.
- Construct new Sheepwash Bridge.
- Alteration works to Botley Road bridge
- Construct subway link under new track.
- Install new line and platform.
- Construct new station building (including nursery) and complete carriageway.
- Complete

6.2 M&E

6.2.1 Incoming Services

An application shall be made to the DNO (SSE Energy Supply Ltd.) for a new LV electrical supply to serve the Phase 2 area of the proposed development

It is anticipated that a new 400A supply will be provided from the existing DNO infrastructure in the Botley Road vicinity, this will terminate in the new plant room which is to be provided to the rear of the proposed new Western Entrance Building. A detailed load assessment should be developed at a future design stage to fully determine the exact electrical load requirements for the proposed works.

The new LV supply will be utilised to serve the new Western Entrance Building, Passenger Subway, Lifts & all services associated with the new Island Platform 4/5.

It is not considered as part of these works that a new gas supply will be required for the proposed Phase 2 development.

A new water supply shall also be provided to the Western Entrance Building and shall be taken from the existing main in Roger Dudman Way. A break tank and booster set shall be provided.

6.2.2 External Lighting

New external lighting shall be installed around the public realm & car parking areas outside the Entrance Building and shall generally comprise post-top column mounted luminaires & wall mounted bulkhead type fixtures. All external lighting is to be provided utilising LED sources and shall be switched via timeclock and photocell.

6.2.3 Internal Lighting

All new internal lighting shall generally comprise of linear and circular recessed LED luminaires, switched locally via manually-operated wall switches & ceiling mounted PIR sensors. An adequate number of the luminaires shall be provided with integral 3 hour self contained, non-maintained emergency packs to provide the emergency lighting.

6.2.4 Small Power

A suitable number of socket outlets shall be provided within each room/area based on the number of persons occupying the space and the equipment within that space. Sockets shall be mounted within partition walls or within limited runs of surface mounted dado trunking.

Mounting heights of the sockets outlets and accessories shall generally be in accordance with the recommendation of the Part M of the Building Regulations

Power supplies shall be provided to all equipment and plant within the building. A new supply shall be provided to the lift motor room for the proposed new passenger lift. Fused connection units and isolators shall be provided as required for fixed items of equipment e.g. ticket machines, hand dryers, disabled call systems, localised ceiling mounted heat pump units, kitchen appliances and ventilation fans etc. New sub metered supplies shall also be provided to serve the proposed concession areas.

6.2.5 Data

Cat 6 cabling shall be installed throughout the accommodation building to serve the data outlets. Data/Voice outlets shall be located to suit proposed furniture and equipment layouts. The cabling shall be terminated at both the outlets and the data/server cabinet. The location of data cabinet is currently assumed to be located in the proposed new IT/Comms Room.

6.2.6 Disabled Call Systems

Disabled assistance alarm systems shall be provided to disabled WC's comprising of a pull switch, a reset switch with reassurance light (located in a position reachable from the WC) and an over door indicator light. All equipment shall be installed in compliance with Approved Document M.

A complete new fire alarm system shall be provided to category L1/P1, as defined in BS5839-1.

The fire alarm shall comprise of surface mounted smoke and heat detectors, sounders, visual indicators, interface units and dedicated fire alarm panel located in the entrance to the Western Entrance Building. It shall be fully open protocol addressable (intelligent) as per Hochiki Europe or equal approved. A link shall be provided to the existing fire alarm in the Station Development.

6.2.7 Heating and cooling

It is proposed to heat the new Western Entrance Building with a combination of the Comfort Cooling packaged split system type heat pumps (heating and cooling) and a Low Temperature Hot Water (LTHW) heating system.

The LTHW system heat source shall be provided by use of an air source heat pump. Electrical air curtains shall also be provided to the main entrance.

6.2.8 Ventilation

The ventilation system shall provide fresh air in at 12l/s per person at quantities to meet the requirements of the Building occupants

Fresh treated supply air shall be drawn into the ventilation system from louvres terminated at high level within the building facade, and shall be distributed within the building via ductwork, grilles and diffusers.

6.2.9 Water

6.2.9.1 Toilets

Toilets shall each be provided with point-of-use un-vented electric water heater mounted within the vanity units or ceiling void. These units and the wash hand basin cold taps shall be connected to the BCWS routed within the ceiling void.

The hot and cold water services shall drop from the ceiling void or rise from the vanity units to serve the wash hand basins.

6.2.9.2 Staff Welfare

Staff Welfare areas shall be provided with a point-of-use un-vented electric water heater mounted under the sink within the cupboards. This unit, the sinks and the basin cold taps shall be connected to the BCWS dropping from the ceiling void to low level.

The un-vented water heater shall be complete with all necessary fixtures and fittings including an expansion vessel, an emergency pressure relief valve and blow down pipe routed to discharge to drain.

6.2.9.3 Disabled WCs

The disabled WC shall be provided with a point-of-use un-vented electric water heater mounted within the IPS panelling. This units and the wash hand basin cold tap shall be connected to the BCWS routed within the ceiling void. The hot and cold water services shall serve the wash hand basins via thermostatic mixing valves, which shall meet the requirements of NHS code TMV3.

A branch connection shall be taken from the BCWS to serve the electric showers from the ceiling void to high level.

6.2.9.4 Public Health

The building shall be provided with a suitably sized primary ventilated single stack system capable of the safe and efficient evacuation of black and grey water from all sanitary fittings. The system shall be a type III system.

Each sanitary fitting shall be provided with a water trap and waste/soil pipe connected to a primary stack.

Generally, the installation shall be a gravity system with the possible exception of condensate drainage from ventilation/comfort cooling plant and equipment, which may require localised pump discharge into the primary stack installation.

The entire installation shall be a mixture of fully ventilated stacks and stub stacks; the full stacks shall ventilate to atmosphere at roof level.

The materials proposed for the installation shall be PVC-u and PVC-mu shall be used for all stacks and main drains branch pipework with water and waterless trap utilising polypropylene.

The entire installation shall fully comply with the requirements of the Employer's Requirements, Part H of the Building Regulations and BS EN 12056.

6.2.9.5 Concession Areas

Dedicated metered water supplies shall be provided to each proposed concession area with isolation for connection to future tenants.

7 New Island Platform 4/5

As part of the Phase 1 Oxford Corridor works, existing Platform 2 will be renumbered to Platform 4. As part of the Phase 2 works, the new Down through line will offer capacity for stopping passenger services. Thus, a new island platform will be constructed.

7.1 Infrastructure

A new island platform will be constructed in phase 2 of the project by adding a new west face to existing platform two. The existing platform will be renumbered four and the new face will become platform five. The proposed track layout is shown in Figure 40.

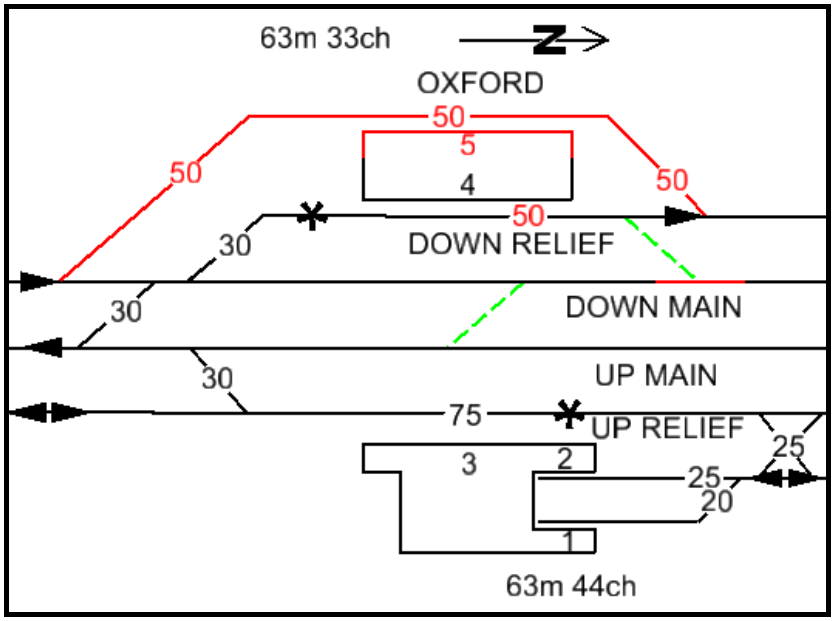

Figure 40 Schematic Phase 2 Track Layout

The platform will be remodelled to accommodate a new passenger entrance, new platform facilities, a realigned existing track and the new track. The GRIP 2 study proposes a platform width of 10.900m as shown in Figure 1, comprised of a 3.500m platform four, a 3.000m allowance for station buildings and a 4.500m platform five. The GRIP 2 platform dimensions will be used for the analysis in this report.

Platform five will be served by a new track which crosses over Botley road, south of the station, on a new bridge. Botley road is lowered to pass beneath the existing railway bridge and it will be necessary to extend the lowered section beneath the new bridge. To minimise the extension the new bridge can be installed higher than the existing bridge. This has the consequence of raising the platform five track above the existing tracks, including the Down Relief which serves platform four.

The difference in levels between platform four and platform five must be accommodated in the surfacing of the platform between them. The gradients of this surface are stipulated in the following standards:

GI/RT7016:

Clause 11.1.3.3: The crossfall shall be at a nominal gradient of 1:50 (within the limits 1:80 to 1:40).

There are three options to satisfy this requirement, each permitting a level difference between platforms four and five.

- A 1:80 fall over the 3.500m wide platform four, a level area of 3.000m for platform buildings, then a 1:40 fall over the 4.500m wide platform five. The advantage of this option is that with no fall across the central section of the platform, provision of thresholds to platform buildings will be greatly simplified. This option allows a maximum differential level of 0.069m between the platforms.
- A 1:80 fall over the 3.500m wide platform four, then a 1:40 fall over the central area and platform five, 7.500m wide in total. The disadvantage of this option lies in the additional complication it brings to thresholds for platform buildings. The lift and subway entrance will open out onto a sloping surface and any platform buildings with doors on both the east and west elevations will require a step on one side to reach the platform. This option allows a maximum differential level of 0.144m.
- A central retaining wall located along the back of platform four. Steps at the subway entrance would be required to accommodate the differential level at this point. The lift would feed onto either platform four or five and lift users wishing to avoid steps would be faced with a detour around the northern end of the platform to a point where the differential level has decreased to zero. We recommend that if this option is pursued, the differential level is limited to 0.300m to minimise the number of steps at the subway entrance and the detour for step free access.

GI/GN7616:

Clause 4.2.3 stipulates a longitudinal fall of 2.5mm/m (1 in 400) where a Technical Specification for Interoperability applies. DfT Interoperability help note 206 which gives guidance on the projects that are required to be interoperable has been reviewed and indicates interoperability is required at Oxford.

Clause 4.2.6 requires that the gradient through a platform should be constant, unless the particular geographical characteristics of the site and the characteristics of the railway infrastructure at the proposed location of the platform do not provide a reasonable opportunity for achieving this. Where the gradient is not constant, the average gradient should be measured over the length of any train likely to use the platform in its planned stopping position.

The fall on proposed platform four is 0.297m over its 275m length, equating to an average fall of 1 in 925. This is composed of a 143.4m straight section at 0.23%, a 77.3m straight section at 0.087% and a vertical curve. With a differential level between the platforms and a design intent to eliminate this differential level in as short a length as possible, compliance with the requirements of GI/GN7616 could be achieved by running the south end of platform five at

steeper than 1 in 400, such that the average gradient is 1 in 400 and the platform meets the plane of platform four as soon as possible.

The total fall achievable along platform five is 0.688m and the maximum differential level between four and five is 0.391m, if the differential level were only to be eliminated at the north end.

In detailed design, the train stopping markers should be set so trains stop as far north as possible, minimising the train length which stands on the steeper section of track.

7.1.1 Western Retaining Wall

As per section 6.1 of this report, a new Western Entrance building is proposed on the site of the existing YHA building and junction to Roger Dudman Way. Figure 41 shows the location of the YHA relative to the existing station buildings which line the Western face of Platform 2 (existing). It should be noted in this photo (albeit the image does not make it obvious) that there is a vertical level change in a relatively small area of land.

Figure 41 A view South from Roger Dudman Way, showing YHA and Platform 2 buildings

The survey and design work undertaken thus far indicate that the vertical level difference between the proposed concourse area of a new entrance, to the surface of proposed Platform 5 would be approximately 3m. This value is at a maximum at the Southern extent of Platform 5 and tends to zero at the Northern extent as the topography of Roger Dudman Way rises such that the vehicle and rail crossing of Sheepwash Bridge are (effectively) co-planar.

It is proposed that reinforced earth is used extensively along the line of the Western wall. A reinforced earth solution is ideal where a retaining wall is needed where in fill is required.

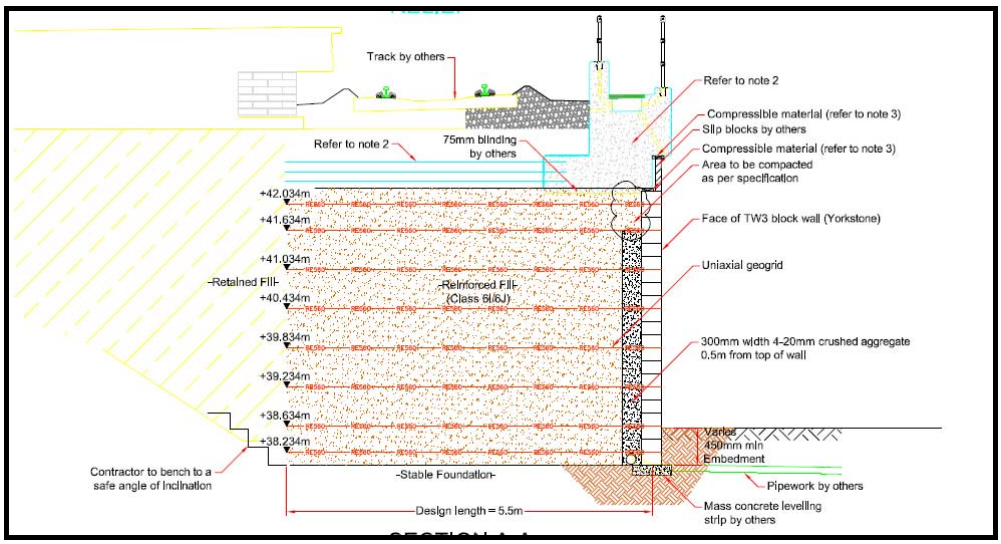

Figure 42 Typical cross-section for a reinforced earth retaining wall (solution was applied to the Northern perimeter of Reading Station)

In general, the rule-of thumb for space requirements between the face of the earth retaining wall and any ground or structures left in place behind the wall is given by 110% of the overall retained height.

There are several design implications that need to be checked and clarified:

- walkway requirements at the top of the wall,
- derailment loading requirements modelled at the top of the wall
- train surcharge loading requirements at the top of the wall
- refuge constructed at every 20m
- any requirements for future OLE bases
- scale of the vertical 3m retained wall
- type of reinforcement used in the soil
- type and nature of engineering fill used behind the wall
- facing requirements on the front of the wall
- space requirements behind the back of the proposed (or amended) line of the wall
- interface with platform structures above the back filled material

- interface with the Western entrance gateway
- interface with subway openings through the wall
- interface with proposed retaining structures at Botley Road Bridge
- any ground improvement requirements to support surcharging of poor ground by the backfill material.

These areas will be explored during the Approval in Principle stage.

7.2 Canopies

The existing canopy provision to platform 2 extends beyond the line of the existing platform buildings to the edge of platform but is limited to the area of coverage. The canopy extends from Botley Road Bridge north to the first stop of the stair tower to the passenger footbridge. Passengers wishing to use the lift to this platform walk from this point to the lift without canopy cover. In addition passengers using platform 5 are not afforded canopy coverage but are provided with 2No.platform waiting shelters.

It is noted that the existing canopy provision oversails the edge of platform to both faces and as such would require modification once electrification is introduced to enable compliance with the electrification clearance gauge. This would require amendments to existing structure and envelope at both eaves locations for the full extent of canopy and also would require the electrification mast to be attached to the existing structure which would need structural justification and proving to ensure this additional load could be accommodated

Once the existing provisions are considered there are several options on which the design could be progressed.

7.2.1 Retain existing canopy provision and do not add to it

Primarily this would not provide adequate coverage to passengers boarding / alighting trains at the new through platform 5 which could result in them getting wet or worse still introduce safety concerns in these areas. This would also not solve the coverage issues to platform 5 or access the passenger lift and would provide severe constraints to the construction team to demolish the building below the canopies and retain the canopies. This could also result in damage to the existing canopies from which remedial measures could prove more onerous than providing a new canopy

7.2.2 Retain existing canopy provision but extend the canopy to cover platform 5

Again this would not provide adequate coverage to passengers boarding / alighting trains at the new through platform 5 which could result in them getting wet or worse still introduce safety concerns in these areas. This would solve the `none coverage` issues and would offer a major improvement to the provision afforded this area of the station. If the existing canopy was retained the question is raised over would the new canopy extent replicate the existing

aesthetic or would a new modern canopy be installed similar to that which forms the proposed solution for phase 1? Both solutions are not ideal. To replicate the same aesthetic as existing to platform 4 would highlight its tired appearance and also provide a distinct difference in terms of quality between the up and down platforms. To provide a modern new extent would tie in well with the proposal for phase 1 but would then further highlight the tired nature of the existing canopy to platform 4 while providing an awkward and potentially flawed detail at the junction.

Any new canopy extent would need to integrate with the existing passenger bridge which would be addressed in the same manor as phase 1 where the proposed canopy shall be framed with a suitable tolerance to the existing bridge of approx 300 – 500mm which shall then allow infill sections of canopy to be installed through either a cantilever approach or to tie in with the existing transoms and mullions of the stair and lift towers. This shall allow the junction to remain as light as possible structurally but also water tight and allow for any differential movement of the two elements.

Again any option of retaining the existing canopy to platform 4 adopts the same issues in terms of maintaining this throughout the demolition of buildings below which would in all reality not be recommended unless deemed a necessity

7.2.3 New Modern Canopy to platform 4 only, or to platforms 4 and 5

To introduce a new modern canopy to platform 4 and 5 allows for full coverage of both aspects of the platform for all passengers boarding / alighting. It also allows this phase of the developments to visually tie in and reflect with those on Phase 1 and also allows a sequenced approach with demolition and construction activities not hindering the other which could be the case as discussed earlier. The minimum this new canopy installation should provide should be from it original southern position to the passenger bridge and equally ensure covered access to the passenger lift. This would be an extension of canopy in the region of 10metres but this is easily justified through safety reasoning and basis good practice. The preferred proposal would be to extend this new extent of canopy beyond the passenger footbridge and onwards to provide the required extent of coverage to platforms 4 and 5. To introduce only half of the platform with coverage could encourage criticism and could also in inclement weather conditions result in over crowding of covered areas with those uncovered not used.

Any new canopy would be designed specifically to incorporate the required electrical clearance gauge to ensure adequate provision for future electrification.

7.2.4 New canopy installations to both the north and south aspects to the proposed platforms 4 & 5

As covered in the previous section the proposed solution to the Phase 2 canopy elements would be for a new modern canopy in the same style as the Phase 1 element, to be introduced to both platform both north and south of the passenger footbridge.

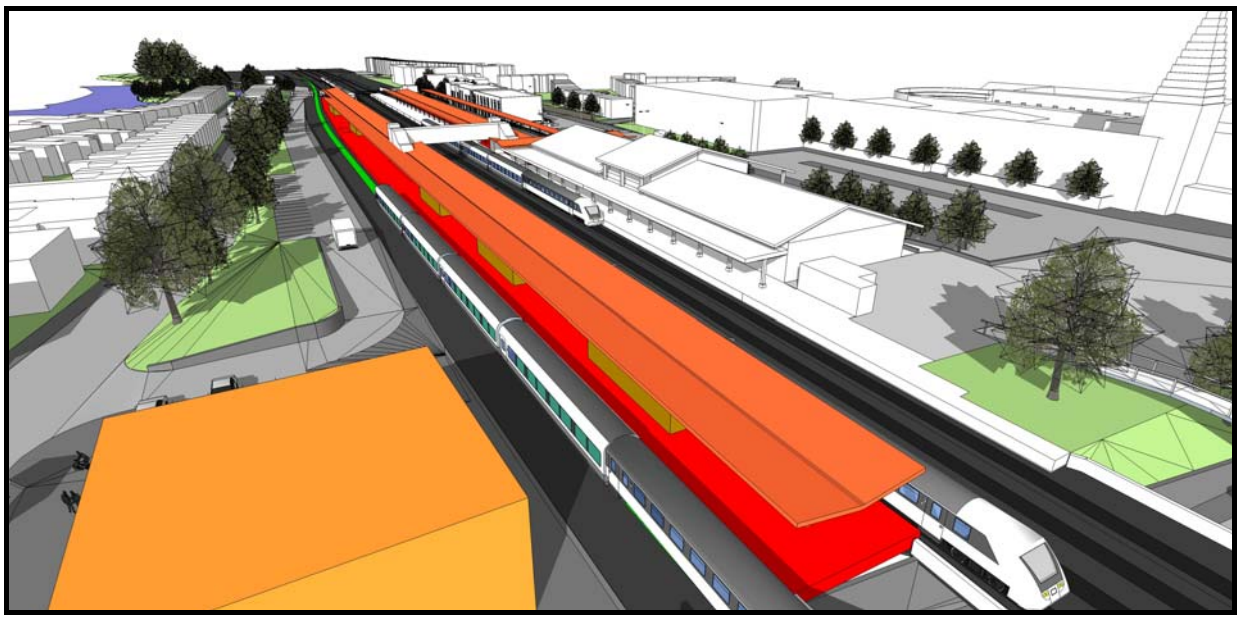

Figure 43 Platform 4/5 Canopies Proposal isometric

Figure 44 Platform 4/5 Canopies Proposal top view

The proposed canopy structure and envelope shall be designed to be as simple as possible, while maintaining the required aesthetic appeal. This shall include a single skin cladding cover to the canopy (coated to both faces) to provide a lightweight but fit for purpose design. The structure shall be modular in design, where possible, with the incline outer sections being the repeat items and the fluctuation of platform profile accommodated through a variable central section. Signage, lighting, customer information systems etc shall all be canopy mounted where possible and practical to remove unwanted obstructions from the platform.

The proposed structures supporting the canopies consist of single and double cantilever frames. Spine beams will span from column to column following the line of the track. Cross beams connect into the spine beams perpendicularly at consistent centres to pick up the cantilevered canopy structure. Drawings show preliminary 'sized' steelwork and are to be confirmed at AiP.

7.2.5 Summary

The modern canopy to the south of the pedestrian footbridge is required to replicate previously provided provision and should be of modern appearance to best tie in with the recommended solution to Phase 1. This would also offer a consistent approach should the master plan not be implemented.

7.2.6 Recommendation

It is recommended that both extents of canopy are provided as shown on the extracts provided so not to have certain passengers not afforded protection from the elements.

7.3 Buildings

On the newly formed platform 4 & 5 a series of platform buildings shall be located to replicate facilities previously provided on platform 4 such as café, WC, information, offices, British Transport Police, Station Master etc. These shall all be new structures and integrated within the new proposed canopy designs.

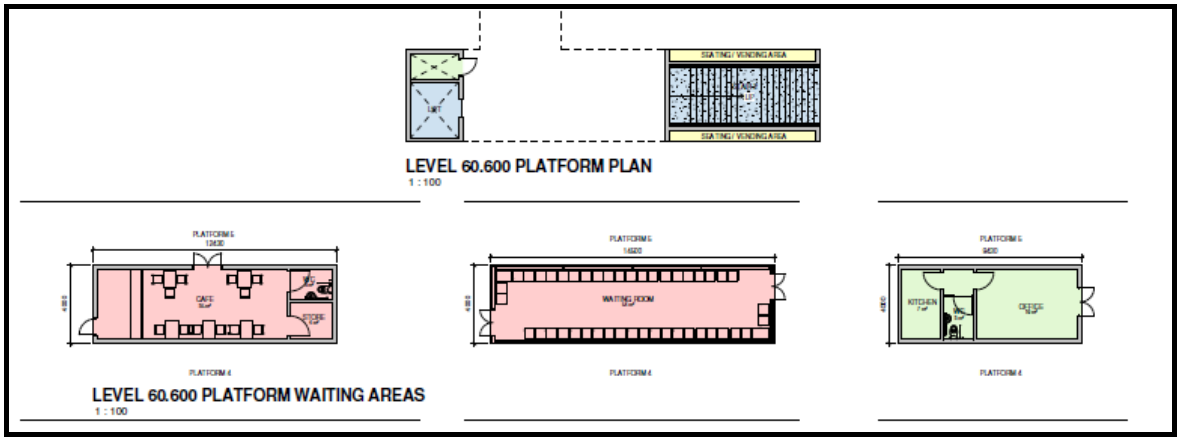

Figure 45 Platform 4/5 Proposed Buildings

7.3.1 Vertical Circulation Building

In theory this is formed from two elements and fed from the subway with a passenger lift and staircase both designed to Network Rail standards. Aligned with the staircase element are two

recessed areas which can be utilised as local bench seating. The platform topography in this area has been developed to provide level unrestricted access from the lift discharge position to all areas of platform

7.3.2 Café

This building is to replace the existing café provision found on platform 4 with a servery, fixed seating and unisex WC provided

7.3.3 Waiting Area

This room provides enclosed waiting for circa 40No.persons

7.3.4 Office

This area provides an office with associated WC and kitchenette provision to enable management of this area of the station to be retained

7.3.5 Facilities not provided

As part of the overall Phase 1 and Phase 2 integration certain facilities currently provided on platform 4 are to be relocated to the first floor element of the new accommodation building adjacent to the new platform 1. This relocation shall enable minimal disruption to the station operation and also form a central location (with the exception of the remote small office building to platform 4 & 5). These facilities include:

- • British Transport Police
- • Station Master Offices
- • Meeting Rooms

7.4 M&E

The new LV supply located in the Western Entrance Building, Passenger shall be routed through the subway to provide power for all services associated with the new Island Platform 4/5.

A new water supply shall also be provided to the Platform directly from the Western Entrance Building to serve the new platform buildings requirements.

Open platform lighting shall generally comprise of high level post top mounted LED luminaires, the covered platform lighting shall utilise linear style LED luminaires mounted on continuous trunking. The lighting scheme shall generally be designed using the same philosophy as the Phase 1 works to provide a coherent scheme across the Station.

A network of buried ducts shall provide services distribution along the platform and serve all platform equipment, lighting and plant.

In the platform areas all cabling shall be routed through a 6 way underground duct system & shall rise vertically through risers located at platform canopy column locations. From this point, cables shall then be routed through a canopy mounted 3 compartment trunking system to serve lighting CIS and telecoms equipment. Any tenanted areas shall be provided with sub-metered electric and water supplies.

7.5 Comms

7.5.1 CCTV

Recover the existing 8(no) CCTV cameras located within the Stage 2 area of works. Install new cameras to provide a similar level of coverage as the existing system. This will require more cameras than the existing system due to the increased area and complexity of the new station building and platform 5. All new cameras to be connected to the existing CCTV control equipment in the train dispatch room on new platform 3. This may require an increase in equipment. Changes shall also be reflected at the line control centre.

7.5.2 Help Points

Recover the existing Help Point on new platform 4 and place in secure storage while construction works are undertaken. Reinstall on the new island platform 4/5.

7.5.3 CIS

Recover the existing 8(no) displays located on new platform 4 and associated buildings and place in secure storage. Once construction works have been undertaken, reinstall these displays along with additional displays to cover the increased area and complexity of the new station.

Refer to section on Frame Room for details of the combined CIS/PA cabinet.

7.5.4 PA

Recover the existing 15(no) speakers, 1(no) microphone, 2(no) Ambient Noise Sensors and 2(no) induction loops located within the Stage 2 area of works. Install new speakers to provide a similar level of coverage as the existing system. This will require more speakers than the existing system due to the increased area and complexity of the new station. It may be necessary to install a new amplifier and/or controller in the combined CIS/PA cabinet, this will depend of the exact number of speakers required which will defend of the station design.

Refer to section on Frame Room for details of the combined CIS/PA cabinet.

7.5.5 Radio

A Private Mobile Radio (PMR) system is in use at the station. The PMR is owned, operated and maintained by FGW.

The base station controller is located in the telecoms equipment room.

7.5.6 TOC Data

The TOC will need to be engaged to identify and specify Data requirements in the new station entrance and new platform area. This will include;

- Ticket Machines
- Gate Line
- Ticket Vending Machines
- IT

7.5.7 Telecoms Equipment Room

Relocate the combined CIS/PA cabinet and associated cabling from the existing telecoms equipment room into the new platform 4/5 station building.

Relocate the radio base station controller from the existing telecoms equipment room into the new platform 4/5 station building.

Relocate any remaining telecoms equipment that has not already been moved by the previous projects / stages of this project.

7.5.8 Cables

The main cable route runs under existing platform 2, extending lineside out of either end. Cables within the route will require protecting from the construction works and the relocating into the new platform 4/5 duct route.

8 Conclusion

The report demonstrates that the implementation of Phase 2 works is eminently possible. However, further design and investigation will be required at AiP and beyond.

The lineside corridor works (Chapter 2) will be simplified by the enabling works completed by Oxford Corridor CP5 (E&P and Telecoms) and GWEP (Electrification). No significant project risks remain in the constraints affecting Track and Infrastructure.

The design of Botley Road highway (Chapter 3) requires consultation with Oxford City Council. Despite a significant road lower, it is still possible to tie into respective East and West targets within permissible gradients, however, the gradients are severe and careful consideration with regard to whole life conditions should be made.

The design of Botley Road highway will ultimately dictate the levels of the side spans (carrying new Down through, and probable new Up through (CP6)). The level of the side span to the new Down through will dictate the Platform 5 surface level at the Southern end. How the relative levels of Platform 4 and Platform 5 are engineered will be influenced by the severity of the difference. It is likely that the level difference will not be significant (c100mm).

The design of Sheepwash Bridge (Chapter 4) is constrained by the geometry of residential property, Sheepwash canal and the proposed new Down through line. The proposed bridge structure can carry its requirements (road, pedestrian, rail) but consideration and investigation must be paid to the existing services. Tata Steel Projects are commissioning a GPR survey for Q4 2014 to further inform staging and permanent design.

The relocation of 3rd party property (Chapter 5) requires engagement with the Youth Hostel and Nursery representatives to fully understand requirements and expectations. Whilst a possible location has been found for the Youth Hostel, the area is known to be contaminated and therefore its availability may be subject to the remediation programme.

The New Western Entrance Building (Chapter 6) is likely to be a prominent building for its relatively short lifespan (based upon the assumption that Oxford Masterplan for the Station area proceeds within CP6 timescales). Liaision with Town Planners is therefore recommended to rationalise design and specification in the face of conflicting requirements.

New island Platform 4/5 (Chapter 7) is relatively simple in its design principles, however, the complexity will lie within the staging and construction. The staging relates to the movement of personnel and equipment displaced by the permanent works, whereas the construction relates to the building of a new subway and facing platform adjacent to a railway which has recently been electrified.

Appendix A Engineering Drawings

A.1 Track

A.1.1 B90505B-DRG-PWY3022

A.1.2 B90505B-DRG-PWY3023

NOTES

1. THIS DESIGN IS BASED UPON LIDAR SURVEY DATA WITH REFERENCE MADE TO AVAILABLE TOPOGRAPHICAL SURVEY FOR THE DOWN RELIEF, DOWN MAIN, UP MAIN AND UP RELIEF TO CONFIRM EXISTING CANT ARRANGEMENTS. WHILST THE EXACT TIE IN ARRANGEMENTS MAY CHANGE, IT IS CONSIDERED THAT THIS COMBINATION OF SURVEY DATA IS SUFFICIENT TO CONFIRM THE FEASIBILITY OF THE ALIGNMENTS PROPOSED ON THIS DRAWING.

2. KEY

PROPOSED NEW TRACK

REALIGNED TRACK

EXISTING TRACK TO REMAIN (SEE NOTE 9)

EXISTING TRACK TO BE REMOVED / SLUED (SEE NOTE 9)

NETWORK RAIL LAND BOUNDARY (INDICATIVE ONLY - TAKEN FROM MARLIN)

FOULING POINT — FP

CLEARANCE POINT — CP

EXISTING SIGNAL / POINTS TO REMAIN — SL OX15 / 223A

EXISTING SIGNAL / POINTS TO BE RECOVERED — SL OX15 / 223A

NEW SIGNAL / POINTS TO BE INSTALLED (BY THIS SCHEME) — SL OX15 / 9120A

EXISTING SIGNAL / POINTS ASSUMED TO HAVE BEEN RENAMED (BY OARS) — SL OX82 SL OD2381 / 233B 9121A

NEW SIGNAL ASSUMED TO HAVE BEEN INSTALLED (BY OARS) — SL OX15

3. DESIGN ABBREVIATIONS USED:

Cg	CANT GRADIENT
CH	CHAINAGE
D	CANT DEFICIENCY
E	APPLIED CANT
CWR	CONTINUOUS WELDED RAIL
Rad	RADIUS
RgE	RATE OF CHANGE OF CANT
RgD	RATE OF CHANGE OF DEFICIENCY
Vm	DESIGN SPEED

4. CLEARANCE POINT = FOULING (1970mm) POINT + 4.880m

5. CHAINAGES AND TRACK RADII ARE SHOWN IN METRES. ALL OTHER DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS OTHERWISE STATED. ALL CLEARANCES AND SIXFOOTS ARE QUOTED TO RUNNING EDGES [RE].

6. CHAINAGE SHOWN IS MEASURED IN METRES ALONG THE EXISTING UP MAIN SIX-FOOT RAIL AND INCREASES WITH MILEAGE. THE DATUM FOR CHAINAGE IS 20000.000m AT THE 63 MILE POST. MILE POST LOCATIONS AND ASSOCIATED CHAINAGE ARE BASED ON OS MAPPING AND ARE THEREFORE INDICATIVE ONLY.

7. CENTRE LINE RADII HAVE BEEN QUOTED IN ALL CASES.

8. BENTLEY RAILTRACK MODEL LOCATION N:\PROJECTS\B905XX\B90505-01FB CP5 Oxford Enabling Works\Track (PWY)\Railtrack Data\ 1. Oxford GRIP 2 Selected Option_02 (08.05.14)

9. EXISTING TRACK ALIGNMENTS SHOWN ON THIS DRAWING ARE BASED ON A COMBINATION OF TOPOGRAPHICAL SURVEY DATA, LIDAR SURVEY DATA, APPROVED FOR CONSTRUCTION TRACK ALIGNMENT DRAWINGS AND PROPOSED TRACK ALIGNMENTS FOR PHASE 1 WORKS.

ALL WORK PROPOSED ON PHASE 1 DRAWINGS ARE SHOWN IN BLACK AS 'EXISTING' TRACK ON THIS DRAWING.

ELSEWHERE THE FOLLOWING APPLIES:

BETWEEN BOTLEY ROAD UNDERBRIDGE AND WOLVERCOT JUNCTION THE DOWN MAIN, UP MAIN AND UP RELIEF ARE BASED ON TOPOGRAPHICAL SURVEY DATA.

THE DOWN RELIEF IS BASED ON TOPOGRAPHICAL SURVEY DATA BETWEEN BOTLEY ROAD UNDERBRIDGE AND CH 21660m. BEYOND THIS POINT THE APPROVED FOR CONTRUCTION ALIGNMENT FOR THE FREIGHT TRAIN LENGTHENING PROJECT IS SHOWN. ARUP DRAWINGS 116491-OX-ARP-TR-DRG-020, 116491-OX-ARP-TR-DRG-021, 116491-OX-ARP-TR-DRG-022, 116491-OX-ARP-TR-DRG-023, AND 116491-OX-ARP-TR-DRG-030 REFER.

ALL OTHER EXISTING ALIGNMENTS ARE BASED ON LIDAR SURVEY.

Letter	Date	Descriptions of revision	Des.	Chkd.	Appr.
P01	12 05 14	GRIP 2 ISSUED FOR INFORMATION	MC	DJM	PRH

Client: Network Rail — Western House, 3rd Floor, 121 Holbrook Way, Swindon, SN1 1BD

TATA STEEL PROJECTS — Meridian House, The Crescent, York, YO24 1AW

Status: PRELIMINARY

Designed: MCUN	Checked: D MURPHY
Approved: P HARRISON	Date: 12/05/2014

CP5 OXFORD CORRIDOR SURVEY ENABLING WORKS

PERMANENT WAY
PROPOSED GENERAL ARRANGEMENT
OXFORD STATION AREA - PHASE 2
GRIP 2 SELECTED OPTION

Scales: 1:500 — CAD: MCUN

PW Workflow State: Issued

DO NOT SCALE

Drawing Number: B90505B-DRG-PWY3022 — Revision: P01

B90505B-DRG-PWY3023

NOTES

1. THIS DESIGN IS BASED UPON LIDAR SURVEY DATA WITH REFERENCE MADE TO AVAILABLE TOPOGRAPHICAL SURVEY FOR THE DOWN RELIEF, DOWN MAIN, UP MAIN AND UP RELIEF TO CONFIRM EXISTING CANT ARRANGEMENTS. WHILST THE EXACT TIE IN ARRANGEMENTS MAY CHANGE, IT IS CONSIDERED THAT THIS COMBINATION OF SURVEY DATA IS SUFFICIENT TO CONFIRM THE FEASIBILITY OF THE ALIGNMENTS PROPOSED ON THIS DRAWING.

2. KEY

PROPOSED NEW TRACK	
REALIGNED TRACK	
EXISTING TRACK TO REMAIN (SEE NOTE 9)	
EXISTING TRACK TO BE REMOVED / SLUED (SEE NOTE 9)	
NETWORK RAIL LAND BOUNDARY (INDICATIVE ONLY - TAKEN FROM MARLIN)	
FOULING POINT	FP
CLEARANCE POINT	CP
EXISTING SIGNAL / POINTS TO REMAIN	SL OX15 / 223A
EXISTING SIGNAL / POINTS TO BE RECOVERED	SL OX15 / 223A
NEW SIGNAL / POINTS TO BE INSTALLED (BY THIS SCHEME)	SL OX15 / 9120A
EXISTING SIGNAL / POINTS ASSUMED TO HAVE BEEN RENAMED (BY OARS)	SL OX82 SL OD2381 / 233B 9121A
NEW SIGNAL ASSUMED TO HAVE BEEN INSTALLED (BY OARS)	SL OX15

3. DESIGN ABBREVIATIONS USED:

Cg	CANT GRADIENT
CH	CHAINAGE
D	CANT DEFICIENCY
E	APPLIED CANT
CWR	CONTINUOUS WELDED RAIL
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RgE	RATE OF CHANGE OF CANT
RgD	RATE OF CHANGE OF DEFICIENCY
Vm	DESIGN SPEED

4. CLEARANCE POINT = FOULING (1970mm) POINT + 4.880m

5. CHAINAGES AND TRACK RADII ARE SHOWN IN METRES. ALL OTHER DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS OTHERWISE STATED. ALL CLEARANCES AND SIXFOOTS ARE QUOTED TO RUNNING EDGES [RE].

6. CHAINAGE SHOWN IS MEASURED IN METRES ALONG THE EXISTING UP MAIN SIX-FOOT RAIL AND INCREASES WITH MILEAGE. THE DATUM FOR CHAINAGE IS 20000.000m AT THE 63 MILE POST. MILE POST LOCATIONS AND ASSOCIATED CHAINAGE ARE BASED ON OS MAPPING AND ARE THEREFORE INDICATIVE ONLY.

7. CENTRE LINE RADII HAVE BEEN QUOTED IN ALL CASES.

8. BENTLEY RAILTRACK MODEL LOCATION N:\PROJECTS\B905XX\B90505-01FB CP5 Oxford Enabling Works\Track (PWY)\Railtrack Data\ 1. Oxford GRIP 2 Selected Option_02 (08.05.14)

9. EXISTING TRACK ALIGNMENTS SHOWN ON THIS DRAWING ARE BASED ON A COMBINATION OF TOPOGRAPHICAL SURVEY DATA, LIDAR SURVEY DATA, APPROVED FOR CONSTRUCTION TRACK ALIGNMENT DRAWINGS AND PROPOSED TRACK ALIGNMENTS FOR PHASE 1 WORKS.

ALL WORK PROPOSED ON PHASE 1 DRAWINGS ARE SHOWN IN BLACK AS 'EXISTING' TRACK ON THIS DRAWING.

ELSEWHERE THE FOLLOWING APPLIES:

BETWEEN BOTLEY ROAD UNDERBRIDGE AND WOLVERCOT JUNCTION THE DOWN MAIN, UP MAIN AND UP RELIEF ARE BASED ON TOPOGRAPHICAL SURVEY DATA.

THE DOWN RELIEF IS BASED ON TOPOGRAPHICAL SURVEY DATA BETWEEN BOTLEY ROAD UNDERBRIDGE AND CH 21660m. BEYOND THIS POINT THE APPROVED FOR CONTRUCTION ALIGNMENT FOR THE FREIGHT TRAIN LENGTHENING PROJECT IS SHOWN. ARUP DRAWINGS 116491-OX-ARP-TR-DRG-020, 116491-OX-ARP-TR-DRG-021, 116491-OX-ARP-TR-DRG-022, 116491-OX-ARP-TR-DRG-023, AND 116491-OX-ARP-TR-DRG-030 REFER.

ALL OTHER EXISTING ALIGNMENTS ARE BASED ON LIDAR SURVEY.

DO NOT SCALE

Letter	Date	Descriptions of revision	Des.	Chkd.	Appr.
P01	12 05 14	GRIP 2 ISSUED FOR INFORMATION	MC	DJM	PRH

Client: Network Rail — Western House, 3rd Floor, 121 Holbrook Way, Swindon, SN1 1BD

TATA STEEL PROJECTS — Meridian House, The Crescent, York, YO24 1AW

Status: PRELIMINARY

Designed: MCUN	Checked: D MURPHY
Approved: P HARRISON	Date: 12/05/2014

CP5 OXFORD CORRIDOR SURVEY ENABLING WORKS

PERMANENT WAY
PROPOSED GENERAL ARRANGEMENT
OXFORD NORTH JUNCTION - PHASE 2
GRIP 2 SELECTED OPTION

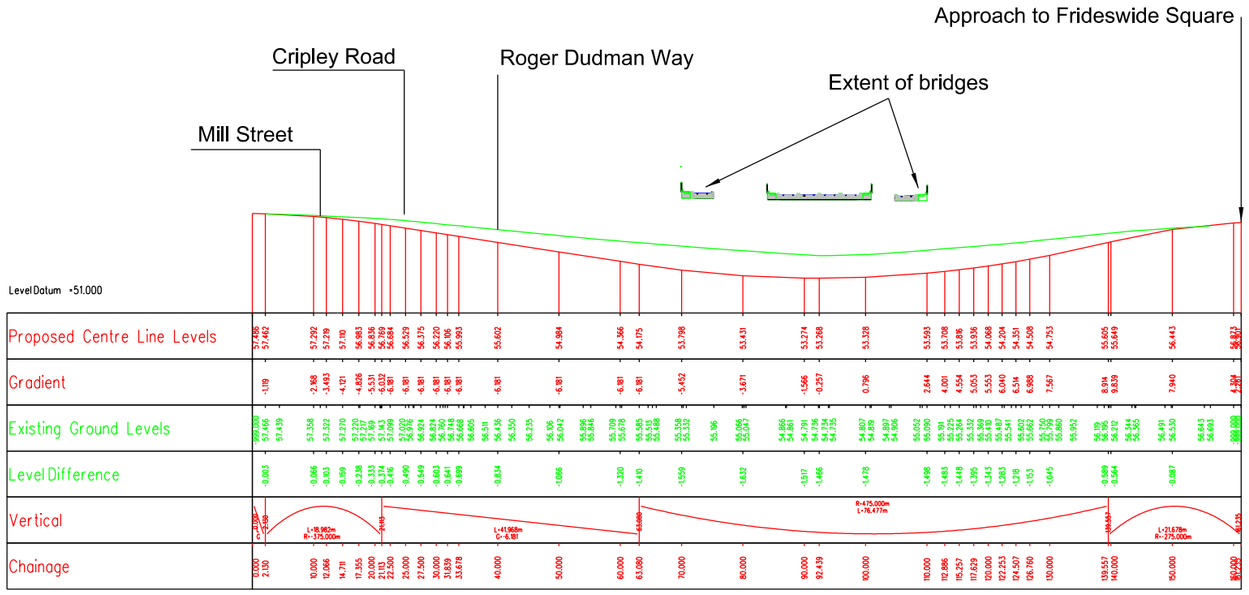
Scales: 1:500 | CAD: MCUN

PW Workflow State: Issued

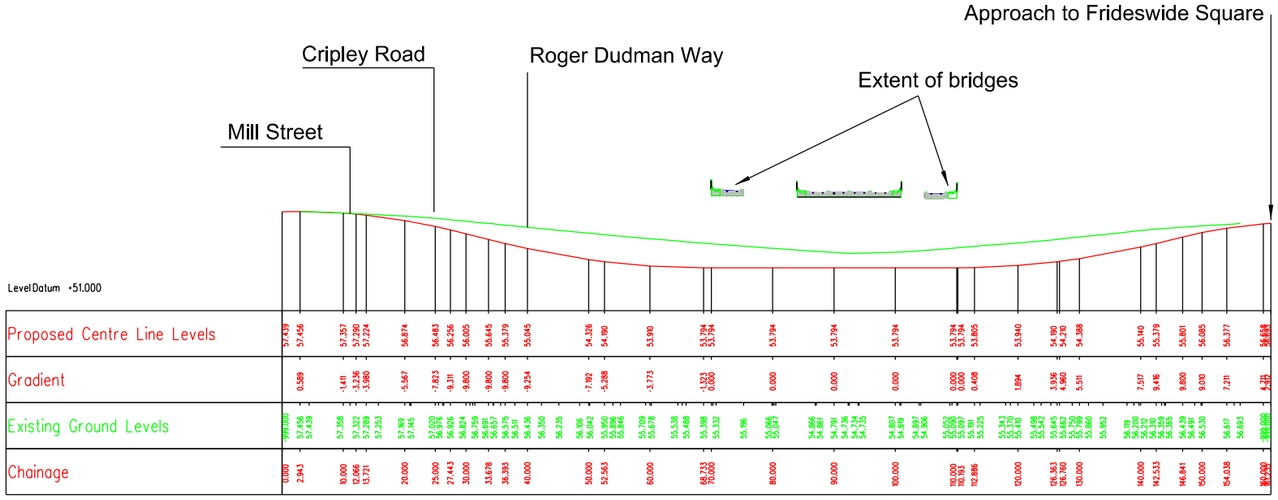
Drawing Number: B90505B-DRG-PWY3023 | Revision: P01

A.2 Highways

A.2.1 W1002B-TTS-SKE-EHW-703001



Option 1 - Sag Option
Horizontal Scale 1:500
Vertical Scale 1:200



Option 2 - Flat Level Option
Horizontal Scale 1:500
Vertical Scale 1:200

BOTLEY ROAD SKETCH - VERTICAL ALIGNMENT OPTIONS

Appendix B IDC Record

B.1 Certificate

B.1.1 W1002B-TTS-CER-EMG-700001

INTERDISCIPLINARY CHECK (IDC) CERTIFICATE		Page
Project No: W1002B (NR), P00050 (TSP)	Stage: GRIP 3 Option Selection	Certificate No: W1002B-TTS-CER-EMG-700001
Project Name: Oxford Corridor CP5 Location Codes 7 & 8 – Phase 2 Works 14th October 2014		

Description of Design Being Reviewed:
New Down Through Road Botley Road and Sheepwash Bridges New Western Entrance Building & Relocation of 3rd Party Property New Facing Platform 5

	Discipline Checked Against							
Discipline Checked	Track	Signals	Telecoms	Civils	Fixed Plant	ETE / Contact System	OLE	Control and Display
Track			X	X				
Signals								
Telecoms								
Civils	X				X		X	
Fixed Plant								
ETE / Contact System								
OLE	X			X				
Control and Display								

Certificate of Interdisciplinary Check

Form Ref	NR/L2/INI/02009/F0046	Issue Date	04/06/2011	Issue	01

IDC Statement:

We the undersigned certify that the drawings listed on the attached schedule(s) in respect of the above project have been the subject of an Interdisciplinary Check, undertaken to eliminate areas of discrepancy between disciplines. This check assumes normal design checks, in accordance with the relevant British, European, Railway Group and Network Rail Company Standards have been carried out by the relevant design organisation(s).

Contractor's Engineer Responsible for Interdisciplinary Check

Function	Contractor	Name	Title	Signature	Date
Track	**TSP**	**David Murphy**	**CRE**		5/11/14.
Signalling					
Telecomms	**CH2M**	**Michael Toher**	**CRE**	pp	13/11/14
Civils	**TSP**	**Oliver Birkill**	**CRE**		6/11/14
(Geo)	**TSP**	**John Judge**	**CRE**		4/11/14
(Highways)	**TSP**	**John Newton**	**CRE**		7/11/14
(Bridges)	**TSP**	**Andrew Wilkinson**	**CRE**		4/11/14
Fixed Plant	**TSP**	**Andrew Craven**	**CRE**		13/11/14
ETE / Contact System					
OLE	**TSP**	**Harry Pascall**	**CRE**		5/11/14
Control and Display					
Buildings	**TSP**	**Paul Parker**	**CRE**		4.11.14

Network Rail

I certify that all reasonable professional skill and care have been used in the IDC described above. I certify that the staff that have carried out the IDC described above are suitably qualified and competent to carry out these duties. (To be completed by the Contractor's Engineering Manager).		
Name: **Alastair Lloyd**	Signature:	Date:
I confirm that all the relevant disciplines HAVE / HAVE NOT* satisfactorily completed The IDC Process on the above documents and the Process IS / IS NOT* complete (To be completed by the Contractor's Engineering Manager).		
Comments Attached YES / NO*		
Name: **Alastair Lloyd**	Signature:	Date:

This sheet to be attached to Office Copy of Design Drawing.

SCHEDULE OF DRAWINGS - The inter-disciplinary check was carried out with reference to the following design drawings

Category

1	Accepted – Proceed to AFC.
2	Accepted – Subject to the design being updated to the attached comments before issuing for construction. Details of the amendments and response schedule, if appropriate, to be forwarded to supplier who raised the comment(s). Author of the document to decide if amendments and response schedule to be forwarded to other suppliers. Proceed to AFC once updated.
3	Rejected – Document to be amended and reissued to all relevant disciplines.

No.	Document No.	Revision	Document Title	Cat
1	W1002B-TTS-REP-EGE-007002	A01	Ground Investigation Report (Geo)	1
2	B90505B-DRG-PWY3022	P01	Oxford Station Area – Phase 2 GA (Track)	n/a
3	W1002B-TTS-MOD-BI-702001	P00.01	Existing Botley Road model (Bridges)	1
4	W1002B-TTS-MOD-BI-702100	P00.05	Proposed Botley Road model (Bridges)	1
5	W1002B-TTS-MOD-BI-802001	P00.01	Existing Sheepwash Bridge model (Bridges)	1
6	W1002B-TTS-MOD-BI-802100	P00.01	Proposed Sheepwash Bridge model (Bridges)	1
7	W1002B-TTS-SKE-EHW-703001	P01	Botley Road Long Section (Highways)	2
8	W1002B-TTS-SKE-EAR-804010	P01	Existing Site Plan Phase 2 (Buildings)	2
9	W1002B-TTS-SKE-EAR-804011	P01	Proposed Site Plan Phase 2 – Option 1 vehicle circulation (Buildings)	2
10	W1002B-TTS-SKE-EAR-804012	P01	Proposed Site Plan Phase 2 – Option 2 vehicle circulation (Buildings)	2
11	W1002B-TTS-SKE-EAR-804001	A01	Proposed Station Building Ground Floor Plan (Buildings)	2
12	W1002B-TTS-SKE-EAR-804002	A01	Proposed Station Building Subway Floor Plan (Buildings)	2
13	W1002B-TTS-SKE-EAR-804003	A01	Proposed Station Building Sections (Buildings)	2

This sheet to be attached to Office Copy of Design Drawing

SCHEDULE OF INTERFACE ISSUES

Category

1	Accepted – Proceed to AFC.
2	Accepted – Subject to the design being updated to the attached comments before issuing for construction. Details of the amendments and response schedule, if appropriate, to be forwarded to supplier who raised the comment(s). Author of the document to decide if amendments and response schedule to be forwarded to other suppliers. Proceed to AFC once updated.
3	Rejected – Document to be amended and reissued to all relevant disciplines.

Document No.	Issue	Category	Raised by	Response by	Date Due
W1002B-TTS-REP-EGE-007002	Major geo-environmental risk identified during GI – contamination present within Down Oxford Engineering Sidings. Further details will be offered in the Contaminated Land Risk Assessment *W1002B-TTS-REP-EGE-007001* due for issue at the end of October.	1	JJ		21/10/14
B90505B-DRG-PWY3022	Existing GSM-R mast to West side of corridor (adjacent to Roger Dudman Way, just South of Sheepwash Bridge) clashes with proposed Down through road (Platform 5). Relocated to existing mast to the North of Oxford Up Sidings.	1	MT		21/10/14
W10002B-TTS-MOD-BI-702100	Constructability of proposed concrete boxes discussed – multiple discrete lengths, precast, extent of in-situ elements required. Report to further explore.	2	GCM	GCM	21/10/14
W10002B-TTS-MOD-BI-702100	Location and size of crane (and likely availability based upon GRIP 6 programme) to be further explored within report. Temporary loading effects of siting crane at North end of Beckett St car park.	2	AL	GCM	21/10/14
W10002B-TTS-MOD-BI-702100	Impact/collision loading provision discussed with respect to line of columns separating footpath from highway on each side of Botley Rd. Level changes between respective surfaces may avoid loading.	2	AL	GCM	21/10/14
W1002B-TTS-SKE-EHW-703001	Highway long section reviewed showing continuous sag curve option. Tie-in to adjacent junctions achieved as per remit however gradients are in excess of 6%, but within 10%. Further optioneering to be undertaken to 'flat bottom' road profile beneath Botley Road to minimise on excavation depth – impact upon junction tie-ins and gradients to be explored.	2	AW	AP	21/10/14
W1002B-TTS-SKE-EHW-703001	Optioneering to be undertaken regarding the desired level of Botley Road side spans (Platform 5 road and proposed Up through) – setting these spans 'high' has excavation benefits, setting the spans 'co-planar' simplifies platform detailing, off-setting the spans by approx 100mm is likely to produce an optimum situation. Highways design to further explore.	2	OB	AP	21/10/14
W1002B-TTS-MOD-BI-702100	Provision of a continuous position of safety discussed on cess path over Botley Road Down through span. Further design to be undertaken at AIP.	2	GCM	OB	21/10/14
W1002B-TTS-SKE-EAR-804011	Proposed footprint of relocated YHA needs consideration with proposed Down Sidings Plant & Infrastructure. Potential clash with DNO, troughing routes etc. Adequate space should be available to accommodate both.	2	AW	PP	21/10/14

SCHEDULE OF INTERFACE ISSUES

Category

1	Accepted – Proceed to AFC.
2	Accepted – Subject to the design being updated to the attached comments before issuing for construction. Details of the amendments and response schedule, if appropriate, to be forwarded to supplier who raised the comment(s). Author of the document to decide if amendments and response schedule to be forwarded to other suppliers. Proceed to AFC once updated.
3	Rejected – Document to be amended and reissued to all relevant disciplines.

Document No.	Issue	Category	Raised by	Response by	Date Due
W1002B-TTS-SKE-EAR-804011	Proposed Phase 1 track layout should be loaded in underneath Phase 2 drawings to provide appropriate context.	2	AL	PP	21/10/14
W1002B-TTS-SKE-EAR-804003	Proposed sections on canopies to P4/5 do not show sufficient coverage. Requires update.	2	AW	PP	21/10/14
W1002B-TTS-SKE-EAR-804001	Train despatch accommodation should be added to North end of P4/5 in line with current provision on P2.	2	AW	PP	21/10/14
W1002B-TTS-SKE-EAR-804001	Telecoms 'Global Crossing' assets to be provided on P4/5.	2	AW	MT	21/10/14

ATTENDANCE AT INTER-DISCIPLINARY CHECK MEETING HELD
AT (location): TATA STEEL PROJECTS, YORK (Room 102)
ON (date): Tuesday 14th October 2014

NAME	COMPANY	PROJECT ROLE
Alastair Lloyd	TSP	CEM
Andy Willson	NR	DPE
Paul Parker	TSP	CRE Architecture
Jessica Watson	TSP	Architecture
Kevin Axtell	TSP	Architecture
John Judge	TSP	CRE Geotechnics
David Murphy	TSP	CRE Track
Oliver Birkill	TSP	CRE Infrastructure
Harry Pascall	TSP	CRE Electrification
Michael Toher	CH2M Hill	CRE Telecoms
Andrew Wilkinson	TSP	CRE Bridges
Greg Collingridge Moore	TSP	Bridges
Andrew Pitter	TSP	Highways

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