

Our ref: CEO-24-1357

Iain Stewart MP
Chair, Transport Select Committee
House of Commons
London SW1A 0AA

Via Email

28 March 2024

Dear Iain,

Re: HS2 Road Safety Audits

Thank you for your letter dated 29th February. In your letter you seek documentary evidence that the Road Safety Audit process has been followed appropriately for HS2 schemes. This is further to our previous correspondence and discussions at Transport Select Committee hearings with both Ministers and HS2 Ltd.

To assist the Committee, an explanatory note about the Highway works and Road Safety Audits in the context of the HS2 Acts is included at Annex A. Documentary evidence about the application of this process with regards to the Yarnfield lane Scheme can be found at Annexes B – E.

I hope this is of use to the Committee.

Yours sincerely,



Sir Jon Thompson
Executive Chair
High Speed Two (HS2) Ltd

cc: Huw Merriman MP, Minister of State for Transport

Annex A

Highway works and Road Safety Audits in the context of the HS2 Act

Background

Under the HS2 Phase One and Phase 2a Acts HS2 is defined as the 'Nominated Undertaker' and is responsible for all works as set out in the Act, including highway works. HS2 Ltd is therefore the 'Overseeing Organisation' in relation to road design and construction and requires Road Safety Audits to be carried out by an independent 'competent person' using the established process adopted across the UK.

When developing standards for the works, HS2 Ltd has adopted all the relevant parts of the Design Manual for Roads and Bridges (DMRB) for its design standards. HS2 Ltd has also based its Specification for Civil Engineering Works on the national Specification for Highway Works (SHW). The same approach is followed by the local highway authorities.

Where the term Overseeing Organisation is used in the DMRB and SHW, it is understood that in accordance with the HS2 Act, HS2 Ltd is the Overseeing Organisation.

To ensure that these arrangements were understood by all parties involved in the design and construction of highway works, HS2 Ltd established a Highways Sub-group under the Local Authority Planning Forum. The sub-group for Phase One commenced in 2013 and for Phase 2a in 2018, they are attended by HS2 Ltd's contractors, Local Authorities and National Highways.

In undertaking the role of the Overseeing Organisation HS2 Ltd is assuring that the work that its contractors have completed to confirm that any safety issues have been satisfactorily addressed before the new or altered road is opened for public use. This is the same as the process followed by local highway authorities and National Highways for their own road schemes.

Road safety audits

The Road Safety Audit (RSA) process in the UK was initially developed for use on motorways and trunk roads and is currently set out in the Design Manual for Roads and Bridges (DMRB) document GG119. As written, the term 'Overseeing Organisation' used in GG119 (and elsewhere) means one of the following (as applicable):

- National Highways
- Transport Scotland
- Welsh Government
- Department for Infrastructure (Northern Ireland)

In practice, it is also used (with or without modification) by nearly all local highway authorities. When this is done, the term Overseeing Organisation needs to be understood accordingly.

The HS2 'Technical Standard – Roads' applies the requirements of the DMRB, GG119 'Road Safety Audits' to all permanent highway works (i.e. on local roads as well as motorways and trunk roads).

To aid understanding of how GG119 is applied in the HS2 context, HS2 Ltd created a Guidance Note, which together with the technical specification was shared at an early stage with all affected highway authorities via the highways sub-group for the relevant phase.

As well as applying to the permanent works, GG119 can also apply to temporary highway works (typically those longer than six months in duration). This is covered in the 'High Speed 2 Phase One and 2a: Route-Wide Traffic Management Plan'. This document was also shared at an early stage via the highways sub-groups. The process for managing highways works has been used for many years across HS2 and is well established.

It should be noted that – GG 119 does not apply to highway works that will not impact road user behaviour or the outcome of a collision.

Role of the Overseeing Organisation

As nominated undertaker, HS2 Ltd has to be understood as the Overseeing Organisation where this term is used in the DMRB and SHW for works constructed under Phase One and 2a Act powers. To do otherwise would be to cede management control to an outside body with no responsibilities under the HS2 Development Agreement to ensure the timely and economic delivery of the works.

Despite HS2 Ltd being the Overseeing Organisation, there are controls in place to protect the legitimate interests of highway authorities, these include:

- All new or altered road layouts require consent and certification from the relevant highway authority.
- The established GG119 process is unchanged, as are the auditor competence and training requirements.
- Any issues or uncertainties arising from the Stage 1 Road Safety Audit and Response Reports are reviewed again and addressed at Stage 2.
- The Stage 1 and stage 2 reports form part of the submission pack for the road layout approval required from the highway authority prior to construction.
- The Stage 3 Road Safety Audit is carried out within one month of the completed highway works opening to public traffic in accordance with GG119.
- The highway authority can become involved as it wishes at any stage of the road safety audit process, and HS2 Ltd can include any comments received from the highway authority in the 'Overseeing Organisation response' column of the decision log in the relevant response report.
- After construction, the highway authority is required to certify that the highway works have been completed to its reasonable satisfaction.

Key points

- GG119 states: “The objective of the road safety audit process is to provide an effective, independent review of the road safety implications of engineering interventions for all road users... to provide an independent check that the design characteristics do not contribute to collisions and/or incidents on highway schemes.”
- The HS2 road safety audit arrangements mirror those adopted by National Highways and local highway authorities using GG119 for their own works – the audit teams are independent from the highway scheme conception, design, construction and operation and are certified as competent in accordance with the requirements of GG119.
- HS2 Ltd’s Overseeing Organisation Specialist (the Lead Highways Engineer):
 - Sits within a separate part of the organisation from the HS2 project teams managing delivery of the permanent and temporary highway works.
 - Has no day-to-day involvement with the contractors, highway designers and their safety audit teams.
- As the Overseeing Organisation, HS2 Ltd also has to consider railway safety as well as road safety when new or altered road is opened for public use.

Yarnfield Lane

Yarnfield Lane is a minor road under the control of Staffordshire County Council that crosses the M6 in the vicinity of the HS2 Stone Infrastructure Maintenance Base (IMB-R). As a result of both permanent and temporary works required for the construction of HS2, the IMB-R and Undertaking and Assurance there was a requirement to divert Yarnfield Lane.

The works included:

- Realignment of Yarnfield Lane
- New bridge over M6 and demolition of the existing structure following completion of construction.
- New temporary slips from the M6 (replacing existing emergency services / maintenance turnaround)
- Vehicular access for IMB-R.

The design of the works associated with Yarnfield Lane had progressed to Scheme Design as part of HS2’s Early Works Contract (ECW2) and was to be revised but work was stopped following the Government announcement in October 2023 to cancel HS2 Phase 2a & 2b.

As part of the scheme design a Stage 1 Road Safety Audit (RSA) was completed by a team independent to the design team. In accordance with the requirements of GG119, the RSA the designer considered whether or not to accept the auditor's recommendation and the Overseeing Organisation either agrees or disagrees with the designer’s proposed action.

At Yarnfield Lane all stage 1 RSA recommendations were accepted and agreed by the designer, as such HS2 Ltd as the Overseeing Organisation did not need to challenge the outcome of RSA. In accordance with normal practice, the recommendations were to be incorporated into the design at the next stage. However, as works were stopped this was not done.

Had the detailed design been undertaken the detailed design (including any amendments arising from the Stage 1 RSA) would have been audited again at Stage 2, again involving Staffordshire County Council.

Annexes B - E: Yarnfield Lane - Application of HS2 standards

Requirement	Comment	Evidence
Road Safety Audit (RSA) Stage 1 completed by team independent from the design team (GG 119).	As Stage 1 RSA was completed in September 2022 by independent audit team in accordance with GG 119. Four safety issues were identified and recommendations made.	Annex B Road Safety Audit report: 2EW02-KIC-HW-REP-WS05-000001
RSA Stage 1 Audit Response prepared by designers and actions agreed with Overseeing Organisation (GG 119).	Audit response prepared by designer and actions agreed with HS2 Ltd as Overseeing Organisation in accordance with GG119. All recommendations accepted and agreed to be implemented.	Annex C Road Safety Audit report response: EW02-KIC-HW-REP-WS05-000002
RSA Stage 1 audit and response reports shared with highway authority for information (HS2 'Guidance Note – Road Safety Audits')	The RSA recommendations and agreed responses were provided to Staffordshire County Council (SCC) as part of Yarnfield Lane IDR with Highway Report. Had there been any comments or concerns from SCC, these would have been incorporated into a revision of the response report.	Annex D IDR minutes recording SCC attendance, topics covered, and information issued: 2EW02-KIC-DS-REG-WS05-000035 Annex E Highways Design Report containing audit information: 2EW02-KIC-HW-REP-WS05-000003

HS2

Phase 2A Enabling Civils Works (ECW2)

M6 Slips and Yarnfield Lane, Site 1– Stage 1 Road Safety Audit

Document no: 2EW02-KIC-HW-REP-WS05-000001

Revision	Author	Reviewed by	Approved by	Date approved	Reason for revision
C01				20/09/2022	For information

Security classification: OFFICIAL

Handling Instructions: NONE

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1 Introduction

This report results from a Stage 1 Road Safety Audit (RSA), carried out on the M6 Slips and Yarnfield Lane Site 1 scheme, and adjacent scheme at Site 1A.

Project overview

High Speed Two (HS2) is a new high-speed railway proposed by the Government to connect major cities in Britain.

Phase Two of HS2 will extend the line to the north-west: to Manchester with connections to the West Coast Main Line (WCML) at Crewe and Golborne. Phase Two will be constructed in two phases, the first being Phase 2a (the Proposed Scheme). Phase 2a is the western section of Phase Two between the West Midlands and Crewe, comprising of approximately 36 miles (58km) of HS2 main line (including the section which would connect with and form the first part of Phase 2b) and two spurs approximately 4 miles (6km) south of Crewe that will allow trains to transfer between the HS2 main line and the existing WCML. Construction of the Proposed Scheme will commence in 2020, ahead of the rest of Phase Two, with operation planned to start in 2027.

Highway scheme subject of this road safety audit

The HS2 Phase 2A route runs parallel to the M6 through Staffordshire. It is proposed to construct a maintenance depot between Stone and Yarnfield, which requires a new dedicated access off the motorway and a replacement for the existing Yarnfield Lane bridge.

The proposed scheme comprises the realignment of a 1.2km length of Yarnfield Lane as a single carriageway road to the northwest of the existing alignment. The scheme also includes a footway / cycleway, a replacement bridge over the M6, M6 southbound entry and exit slip roads with a link to Yarnfield Lane, and M6 northbound temporary slip roads and roundabout with a link to Yarnfield Lane. There is also a requirement to temporarily widen a 500m long length of Yarnfield Lane located east of the M6, known as Site 1A.

Departures from standard are listed in Appendix A.

The location of problems raised are shown on the plan provided in Appendix B.

The RSA brief, dated 29 June 2022, was prepared and supplied by [REDACTED], RPS, and approved by [REDACTED] on behalf of HS2 Ltd.

The RSA team membership, approved by [REDACTED], HS2 Ltd was as follows:

Team Leader

[REDACTED] BEng CEng CMgr MCIHT MCMI MSoRSA AMICE RSA Certificate of Competency
Kier Design Services

Team Member

[REDACTED] HND MCIHT MSoRSA RSA Certificate of Competency
Kier Design Services

The RSA took place at the Kier Design Services Penrith office during September 2022 and comprised of an examination of the RSA brief, information provided with the RSA brief as listed in Appendix A, and a site visit.

The site visit was undertaken on 6 September 2022, between 11:30 and 12:00, by both members of the RSA team together. At the time of the site visit the weather was fine and the existing road surface was dry. Traffic was free flowing on both the M6 and Yarnfield Lane. No pedestrians, cyclists or horse-riders were observed within the scheme extents on Yarnfield Lane.

The terms of reference of the RSA are as described in DMRB document GG 119 'Road Safety Audit'. The RSA team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria.

2 Items raised at previous road safety audits

This is the first formal RSA of the scheme.

3 Items raised at this Stage 1 road safety audit

3.1 Problem

Location:	Junction of farm access and Yarnfield Lane (drawing ref: 2EW02-KIC-HW-DPP-WS05-000001)
Summary:	Risk of junction collisions could lead to motorists being injured.
	The scheme proposes to provide a new farm access on Yarnfield Lane at chainage 250m. Visibility from the new access to the right could be restricted should a vehicle restraint system, bridge parapet, fence or other street furniture be placed within the visibility splay. Any restriction to visibility will increase the risk of collisions between turning vehicles and oncoming traffic and could lead to motorists being injured.
Recommendation:	It is recommended that sufficient visibility for predicted traffic flows and 85 th percentile speeds on Yarnfield Lane is provided from the farm access.

3.2 Problem

Location:	M6 southbound access junction with Yarnfield Lane (drawing ref: 2EW02-KIC-HW-DPP-WS05-000001)
Summary:	Risk of junction collisions could lead to motorists being injured.
	The scheme proposes to provide a new junction from the M6 southbound access on Yarnfield Lane at chainage 600m. Visibility from the new junction to the right could be restricted should a vehicle restraint system, bridge parapet, fence or other street furniture be placed within the visibility splay. Any restriction to visibility will increase the risk of collisions between turning vehicles and oncoming traffic and could lead to motorists being injured.
Recommendation:	It is recommended that sufficient visibility for predicted traffic flows and 85 th percentile speeds on Yarnfield Lane is provided from the junction.

3.3 Problem

Location:	Yarnfield Lane footway / cycleway adjacent to steep slopes
Summary:	Risk of pedestrians and cyclists falling down steep slopes could lead to them being injured.
	The scheme proposes a new footway / cycleway along the southern verge of Yarnfield Lane. In some locations, the footway / cycleway appears to be located close to the top of steep slopes. In these locations, there will be an increased risk of pedestrians and cyclists falling down the steep slopes, which could lead to them being injured.
Recommendation:	It is recommended that measures be introduced to prevent pedestrians and cyclists falling down steep slopes that are adjacent to the footway / cycleway.

3.4 Problem

Location:	Yarnfield Lane footway / cycleway at chainages 0m and 1203m (drawing refs: 2EW02-KIC-HW-DPL-WS05-000059 and 000160)
Summary:	Risk of pedestrians and cyclists being struck by vehicles, leading to them being injured.
	The scheme proposes a new footway / cycleway along the southern verge of Yarnfield Lane. The terminal points of the facility are at chainages 0m and 1203m. There are no details of how pedestrians and cyclists are to join or leave the facility, or what the facility links to. Therefore, as they join or leave the facility, pedestrians and cyclists could be in conflict with vehicles, leading to collisions and associated injuries.
Recommendation:	It is recommended that suitable terminal points are provided on the footway / cycleway to allow pedestrians and cyclists to join and leave the facility.

4 Audit team statement

We certify that this road safety audit has been carried out in accordance with GG 119:

Road Safety Audit Team Leader

██████████ BEng CEng CMgr MCIHT MCMI MSoRSA AMICE RSA Certificate of Competency
Kier Design Services
Highways Depot
Agricultural Hall
Penrith
Cumbria CA11 0DN

Signed



Date 20/09/2022

Road Safety Audit Team Member

██████████ HND MCIHT MSoRSA RSA Certificate of Competency Kier Design Services
Highways Depot
Agricultural Hall
Penrith
Cumbria CA11 0DN

Signed



Date 20/09/2022

Appendix A. Information provided

Table 1: Drawings provided with the RSA brief

Drawing reference	Revision	Drawing title
2EW02-KIC-HW-DPL-WS05-000027	P01.1	Site 1 – Drainage Layout Sheet 1
2EW02-KIC-HW-DPL-WS05-000028	P01.1	Site 1 – Drainage Layout Sheet 2
2EW02-KIC-HW-DPL-WS05-000029	P01.1	Site 1 – Drainage Layout Sheet 3
2EW02-KIC-HW-DPL-WS05-000030	P01.1	Site 1 – Drainage Layout Sheet 4
2EW02-KIC-HW-DPL-WS05-000031	P01.1	Site 1 – Drainage Layout Sheet 5
2EW02-KIC-HW-DPL-WS05-000153	P01.1	Site 1 – Drainage Layout Sheet 6
2EW02-KIC-HW-DPL-WS05-000154	P01.1	Site 1 – Drainage Layout Sheet 7
2EW02-KIC-HW-DPL-WS05-000155	P01.1	Site 1 – Drainage Layout Sheet 8
2EW02-KIC-HW-DPL-WS05-000190	P01.1	Site 1 – Standard Earthworks Details Drawing Sheet 1
2EW02-KIC-HW-DPL-WS05-000191	P01.1	Site 1 – Standard Earthworks Details Drawing Sheet 2
2EW02-KIC-HW-DPL-WS05-000192	P01.1	Site 1 – Standard Earthworks Details Drawing Sheet 3
2EW02-KIC-HW-DPL-WS05-000193	P01.1	Site 1 – Standard Earthworks Details Drawing Sheet 4
2EW02-KIC-HW-DPL-WS05-000017	P01.1	Site 1 – Fencing Layout Sheet 1
2EW02-KIC-HW-DPL-WS05-000018	P01.1	Site 1 – Fencing Layout Sheet 2
2EW02-KIC-HW-DPL-WS05-000019	P01.1	Site 1 – Fencing Layout Sheet 3
2EW02-KIC-HW-DPL-WS05-000020	P01.1	Site 1 – Fencing Layout Sheet 4
2EW02-KIC-HW-DPL-WS05-000021	P01.1	Site 1 – Fencing Layout Sheet 5
2EW02-KIC-HW-DPL-WS05-000150	P01.1	Site 1 – Fencing Layout Sheet 6
2EW02-KIC-HW-DPL-WS05-000151	P01.1	Site 1 – Fencing Layout Sheet 7
2EW02-KIC-HW-DPL-WS05-000152	P01.1	Site 1 – Fencing Layout Sheet 8
2EW02-KIC-HW-DPP-WS05-000001	P01.1	Site 1 – Geometric Plan & Profile Mainline Sheet 1
2EW02-KIC-HW-DPP-WS05-000002	P01.1	Site 1 – Geometric Plan & Profile Mainline Sheet 2
2EW02-KIC-HW-DPP-WS05-000004	P01.1	Site 1 – Geometric Plan & Profile M6 Southbound Diverge
2EW02-KIC-HW-DPP-WS05-000005	P01.1	Site 1 – Geometric Plan & Profile M6 Southbound Merge Sheet 1
2EW02-KIC-HW-DPP-WS05-000006	P01.1	Site 1 – Geometric Plan & Profile M6 Southbound Merge Sheet 2
2EW02-KIC-HW-DPP-WS05-000008	P01.1	Site 1 – Geometric Plan & Profile Farm Access
2EW02-KIC-HW-DPL-WS05-000194	P01.1	Site 1 – Geometric Plan & Profile M6 Northbound Diverge
2EW02-KIC-HW-DPL-WS05-000195	P01.1	Site 1 – Geometric Plan & Profile M6 Northbound Merge
2EW02-KIC-HW-DPL-WS05-000055	P01.1	Site 1 – Kerbs, Footways, Cycleways and Paved Areas Sheet 1
2EW02-KIC-HW-DPP-WS05-000056	P01.1	Site 1 – Kerbs, Footways, Cycleways and Paved Areas Sheet 2

Drawing reference	Revision	Drawing title
2EW02-KIC-HW-DPL-WS05-000057	P01.1	Site 1 – Kerbs, Footways, Cycleways and Paved Areas Sheet 3
2EW02-KIC-HW-DPL-WS05-000058	P01.1	Site 1 – Kerbs, Footways, Cycleways and Paved Areas Sheet 4
2EW02-KIC-HW-DPL-WS05-000059	P01.1	Site 1 – Kerbs, Footways, Cycleways and Paved Areas Sheet 5
2EW02-KIC-HW-DPL-WS05-000159	P01.1	Site 1 – Kerbs, Footways, Cycleways and Paved Areas Sheet 6
2EW02-KIC-HW-DPL-WS05-000160	P01.1	Site 1 – Kerbs, Footways, Cycleways and Paved Areas Sheet 7
2EW02-KIC-HW-DPL-WS05-000161	P01.1	Site 1 – Kerbs, Footways, Cycleways and Paved Areas Sheet 8
2EW02-KIC-HW-DPL-WS05-000050	P01.1	Site 1 - Pavement Layout Sheet 1
2EW02-KIC-HW-DPL-WS05-000051	P01.1	Site 1 - Pavement Layout Sheet 2
2EW02-KIC-HW-DPL-WS05-000052	P01.1	Site 1 - Pavement Layout Sheet 3
2EW02-KIC-HW-DPL-WS05-000053	P01.1	Site 1 - Pavement Layout Sheet 4
2EW02-KIC-HW-DPL-WS05-000054	P01.1	Site 1 - Pavement Layout Sheet 5
2EW02-KIC-HW-DPL-WS05-000156	P01.1	Site 1 - Pavement Layout Sheet 6
2EW02-KIC-HW-DPL-WS05-000157	P01.1	Site 1 - Pavement Layout Sheet 7
2EW02-KIC-HW-DPL-WS05-000158	P01.1	Site 1 - Pavement Layout Sheet 8
2EW02-KIC-HW-DDE-WS05-000005	P01.1	Site 1 – Pavement Typical Details Sheet 1
2EW02-KIC-HW-DDE-WS05-000015	P01.1	Site 1 – Pavement Typical Details Sheet 2
2EW02-KIC-HW-DDE-WS05-000016	P01.1	Site 1 – Pavement Typical Details Sheet 3
2EW02-KIC-HW-DDE-WS05-000017	P01.1	Site 1 – Pavement Typical Details Sheet 4
2EW02-KIC-HW-DDE-WS05-000018	P01.1	Site 1 – Pavement Typical Details Sheet 5
2EW02-KIC-HW-DPL-WS05-000204	P01.1	Site 1A – Fencing Layout Yarnfield Lane
2EW02-KIC-HW-DPL-WS05-000205	P01.1	Site 1A – Kerbs, Footways, cycleways and Paved Areas Yarnfield Lane
2EW02-KIC-HW-DPL-WS05-000207	P01.1	Site 1A – Pavement Layout Yarnfield Lane
2EW02-KIC-HW-DPL-WS05-000208	P01.1	Site 1A – Road Markings Yarnfield Lane
2EW02-KIC-HW-DPL-WS05-000210	P01.1	Site 1A – Site Clearance Yarnfield Lane

Table 2: Other information provided with the RSA brief

Document reference	Title
N/A	Average Daily Weekday Traffic Flows in Peak Month Figure A.1
N/A	Accident data (crashmap.com) Figure B.1

M6 Slips and Yarnfield Lane, Site 1- Stage 1 Road Safety Audit

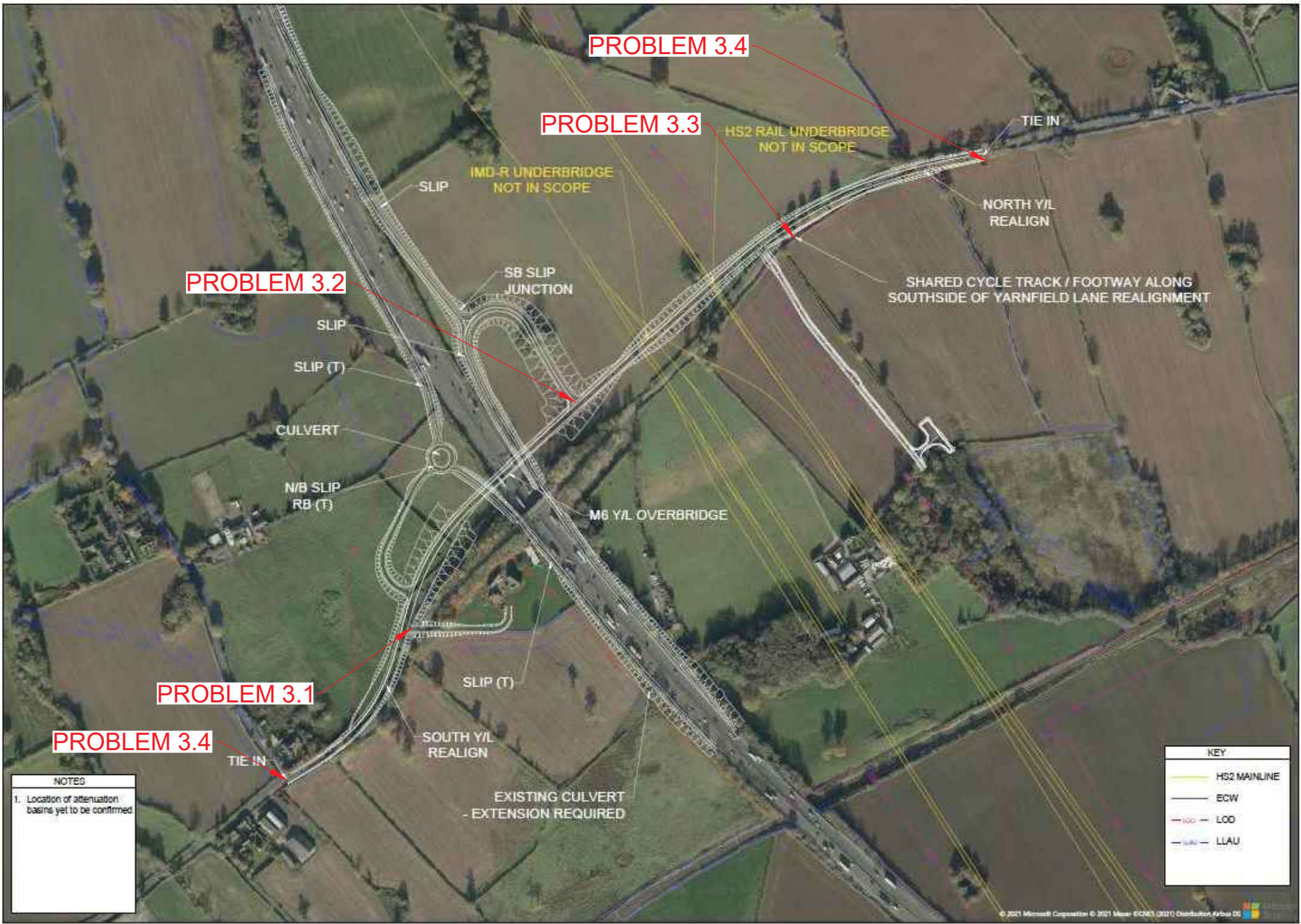
Document no: 2EW02-KIC-HW-REP-WS05-000001

Revision: C01

Table 3: Departures from standards notified to the RSA team

Details					
Site1-001	Departure	Geometry - Horizontal Alignment	Realigned Yarnfield Lane Ch.0+086 to Ch.0+172	Design speed 85kph: R= 510m desirable minimum R from CD109	Design speed 85kph: R= 200m, 3 Steps Below
Site1-002	Departure	Geometry - Horizontal Alignment	Realigned Yarnfield Lane Ch.0+319 to Ch.0+386	Design speed 85kph: R= 510m desirable minimum R from CD109	Design speed 85kph: R= 255m, 2 Steps Below
Site1-003	Departure	Geometry - Vertical Alignment	Realigned Yarnfield Lane Ch.0+470 (Ch300 - 640m)	Design speed 85kph: Crest K= 55 desirable minimum K from CD109	Design speed 85kph: Crest K= 30, 1 Step Below, Combination with Departure Site1-001
Site1-004	Departure	Geometry - Stopping Sight Distance	Realigned Yarnfield Lane Ch.-0+042 to Ch.0+074	Design speed 85kph: SSD=160m desirable minimum K from CD109	Design speed 85kph: SSD <120m, 2 Steps Below
Site1-005	Departure	Geometry - Stopping Sight Distance	Realigned Yarnfield Lane Ch.0+140 to Ch.0+240	Design speed 85kph: SSD=160m desirable minimum K from CD109	Design speed 85kph: SSD <160m; > 120m, 1 Step Below
Site1-006	Departure	Geometry - Stopping Sight Distance	Realigned Yarnfield Lane Ch.0+270 to Ch.0+440	Design speed 85kph: SSD=160m desirable minimum K from CD109	Design speed 85kph: SSD <160m; > 120m, 1 Step Below
Site1-007	Departure	Geometry - Stopping Sight Distance	Realigned Yarnfield Lane Ch.0+440 to Ch.0+540	Design speed 85kph: SSD=160m desirable minimum K from CD109	Design speed 85kph: SSD < 120m, 2 Steps Below
Site1-008	Departure	Geometry - Stopping Sight Distance	Realigned Yarnfield Lane Ch.0+540 to Ch.0+720	Design speed 85kph: SSD=160m desirable minimum K from CD109	Design speed 85kph: SSD <160m; > 120m, 1 Step Below
Site1-009	Departure	Geometry - Vertical Alignment - cycle track	Realigned Yarnfield Lane Ch.0+640 to Ch.0+672	Geometry - 5% gradient within 30m on cycle track	Geometry - 5.83% gradient for 31.85m
Site1-010	Departure	Geometry - Junction Visibility	Realigned Yarnfield Lane Ch.0+600	Design speed 85kph: SSD=160m desirable minimum K from CD109	Design speed 85kph: SSD <120m, 2 Steps Below
Site1 -011	Departure	Geometry - Cross Sectional Width	M6 Northbound Diverge Slip Road	Cross Sectional Width - to provide 3.30m hardshoulder from CD127	Cross Sectional Width - No 3.30m hardshoulder provided
Site1 -012	Departure	Geometry - Horizontal Alignment	M6 Northbound Diverge Slip Road	Design speed 120kph: Minimum Nose Ratio 1:15 ; Nose Length 80m from CD122	Reduced ratio; Nose Length 55m
Site1 -012	Departure	Geometry - Cross Sectional Width	M6 Northbound Diverge Slip Road	Cross Sectional Width - to provide 3.30m hardshoulder; 1m Hardstrip; 3.7 m Carraigeway Lane from CD127	Cross Sectional Width - No 3.30m hardshoulder, No 0.7m hardstrip provided; Reduced Carraigeway Lane for 40m
Site1 -013	Departure	Geometry - Horizontal Alignment	M6 Northbound Diverge Slip Road	Design speed 70ph: Transition lengths of 93m to be provided from CD109	No Transition lengths provided to horizontal radius 360m
Site1 -014	Departure	Geometry - Stopping Sight Distance	M6 Northbound Diverge Slip Road	Design speed 70ph: 120m Stopping Sight Distance to be provided throughout connector road, from back of nose	Design speed 70kph: SSD <70m, 3 Steps Below
Site1 -015	Departure	Geometry - Horizontal Alignment	M6 Northbound Merge Slip Road	Design speed 70ph: R= 360m desirable minimum R from CD109	Design speed 85kph: R= 158m, 3 Steps Below
Site1 -016	Departure	Geometry - Horizontal Alignment	M6 Northbound Merge Slip Road	Design speed 70ph: Transition lengths of 62m to be provided from CD109	No Transition lengths provided to horizontal radius 158m
Site1 -017	Departure	Geometry - Horizontal Alignment	M6 Northbound Merge Slip Road	Design speed 70ph: Connector road shall include a near straight at back of nose at least equal in length to the nose	No near straight provided
Site1 -019	Departure	Geometry - Horizontal Alignment	M6 Southbound Merge Slip Road	Design speed 120kph: Minimum 230m Auxiliary Lane length from CD 122	192m Auxiliary lane length provided
Site1 -020	Departure	Geometry - Horizontal Alignment	M6 Southbound Merge Slip Road	Design speed 120kph: Minimum Nose Ratio 1:40 ; Nose Length 115m from CD122	Reduced ratio; Nose Length 73m
Site1 -021	Departure	Geometry - Horizontal Alignment	M6 Southbound Merge Slip Road	Design speed 70ph: R= 360m desirable minimum R from CD109	Design speed 70kph: R= 180m, 2 Steps Below
OFFICIAL					
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M6 Slips and Yarnfield Lane, Site 1 - Stage 1 Road Safety Audit Brief					
Document no: 2EW02-KIC-HW-REP-WS05-000017					
Revision: C02					
Site1 -022	Departure	Geometry - Horizontal Alignment	M6 Southbound Merge Slip Road	Design speed 70ph: Transition lengths of 30m to be provided from CD109	Design speed 70ph: Transition length of 20m provided to horizontal radius 37.5m
Site1 -023	Departure	Geometry - Horizontal Alignment	M6 Southbound Merge Slip Road	Design speed 70ph: Minimum Radius of 75m for Connector Road Loops	Design speed 70ph: Connector Road Loops of 37.5m provided
Site1 -024	Departure	Geometry - Horizontal Alignment	M6 Southbound Merge Slip Road	Design speed 70ph: Transition lengths of 110m to be provided from CD109	Design speed 70ph: Transition length of 25m provided to horizontal radius 510m

Appendix B. Problem location plan



HS2

Phase 2A Enabling Civils Works (ECW2) M6 Slips and Yarnfield Lane, Site 1 – Road Safety Audit Stage 1 Designers Response Report

Document no: 2EW02-KIC-HW-REP-WS05-000002

Revision	Author	Reviewed by	Approved by	Date approved	Reason for revision
C01				29/09/2022	For Acceptance

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Handling Instructions: None

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4.0	Design Organisation & Overseeing Organisation Statements	7

1.0 Introduction

- 1.1 This Report responds to the Stage 1 Road Safety Audit report for the Phase 2A Enabling Civils Works (Ecw2), M6 Slips and Yarnfield Lane, Site 1 scheme (report reference: 2EW02-KIC-HW-REP-WS05-000002 dated 20 September 2022).
- 1.2 The proposed scheme comprises the realigned Yarnfield Lane which is a 1.2 km single carriageway road including online footway / cycleway to be located to the north-west of the existing Yarnfield Lane. The scheme also includes a replacement bridge over the M6, M6 southbound slip roads and roundabout, and M6 northbound temporary slip roads and roundabout.
- 1.3 There is also a requirement to temporarily widen Yarnfield Lane for approximately 500m in length during the construction of HS2.

2.0 Key Personnel

	Role	Name	Organisation
Overseeing organisation			HS2
RSA team			Kier
			Kier
Design organisation			RPS
			RPS
			RPS

3.0 Road Safety Audit Decision Log

No.	RSA Problem	RSA Recommendation	Design Organisation Response	Overseeing Organisation Response	Agreed RSA Action
3.1	Risk of junction collisions could lead to motorists being injured. The scheme proposes to provide a new farm access on Yarnfield Lane at chainage 250m. Visibility from the new access to the right could be restricted should a vehicle restraint system, bridge parapet, fence or other street furniture be placed within the visibility splay. Any restriction to visibility will	It is recommended that sufficient visibility for predicted traffic flows and 85th percentile speeds on Yarnfield Lane is provided from the farm access.	Accept Full junction visibility is achieved, and is measured in accordance with CD 123 where the X distance is 2.4m on the minor road and the Y distance along the major road is 160m (des. min SSD for 85kph design speed Yarnfield Lane) in both directions.	Agreed Discussed at meeting 03/09/22	

No.	RSA Problem	RSA Recommendation	Design Organisation Response	Overseeing Organisation Response	Agreed RSA Action
	increase the risk of collisions between turning vehicles and oncoming traffic and could lead to motorists being injured.				
3.2	Risk of junction collisions could lead to motorists being injured. The scheme proposes to provide a new junction from the M6 southbound access on Yarnfield Lane at chainage 600m. Visibility from the new junction to the right could be restricted should a vehicle restraint system, bridge parapet, fence or other	It is recommended that sufficient visibility for predicted traffic flows and 85th percentile speeds on Yarnfield Lane is provided from the junction.	Accept Junction visibility to the left is achieved, and is measured in accordance with CD 123 where the X distance is 2.4m on the minor road and the Y distance along the major road is 160m (des. min SSD for 85kph design speed Yarnfield Lane) in both directions. A departure from standard is proposed for reduced visibility to the right due to the crest of the M6 overbridge.	Agreed Discussed at meeting 03/09/22	

No.	RSA Problem	RSA Recommendation	Design Organisation Response	Overseeing Organisation Response	Agreed RSA Action
	street furniture be placed within the visibility splay. Any restriction to visibility will increase the risk of collisions between turning vehicles and oncoming traffic and could lead to motorists being injured.		Mitigation measures will be provided with advance warning signs to motorists on Yarnfield lane included to advise of junction ahead.		
3.3	Risk of pedestrians and cyclists falling down steep slopes could lead to them being injured. The scheme proposes a new footway / cycleway along the southern verge of Yarnfield Lane. In some locations, the footway / cycleway appears to be	It is recommended that measures be introduced to prevent pedestrians and cyclists falling down steep slopes that are adjacent to the footway / cycleway.	Accept Measures will be provided to reduce the risk.	Agreed Discussed at meeting 03/09/22	

No.	RSA Problem	RSA Recommendation	Design Organisation Response	Overseeing Organisation Response	Agreed RSA Action
	located close to the top of steep slopes. In these locations, there will be an increased risk of pedestrians and cyclists falling down the steep slopes, which could lead to them being injured.				
3.4	Risk of pedestrians and cyclists being struck by vehicles, leading to them being injured. The scheme proposes a new footway / cycleway along the southern verge of Yarnfield Lane. The terminal points of the facility are at chainages 0m and 1203m. There are no details of how pedestrians	It is recommended that suitable terminal points are provided on the footway / cycleway to allow pedestrians and cyclists to join and leave the facility.	Agreed – the alignment design will be updated to provide suitable termination points in line with best practice.	Agreed Discussed at meeting 03/09/22	

No.	RSA Problem	RSA Recommendation	Design Organisation Response	Overseeing Organisation Response	Agreed RSA Action
	and cyclists are to join or leave the facility, or what the facility links to. Therefore, as they join or leave the facility, pedestrians and cyclists could be in conflict with vehicles, leading to collisions and associated injuries.				

4.0 Design Organisation & Overseeing Organisation Statements

Design Organisation Statement

On behalf of the Design Organisation I certify that:	
1) The RSA actions identified in response to the Road Safety Audit problems in this Road Safety Audit have been discussed and agreed with the Overseeing Organisation.	
Name:	
Signed:	
Position:	
Organisation:	RPS
Date:	20/10/2022

Overseeing Organisation Statement

On behalf of the Overseeing Organisation I certify that:	
1) The RSA actions identified in response to the Road Safety Audit problems in this Road Safety Audit have been discussed and agreed with the Design Organisation; and	
2) The agreed RSA actions will be progressed.	
Name:	
Signed:	X  
Position:	
Organisation:	HS2
Date:	

HS2

2EW02

Tranche 1 Site 1 - Interdisciplinary Design Review (IDR) Form – Scheme Design

Document no: 2EW02-KIC-DS-REG-WS05-000035

Work Package Ref:

Revision	Author	Reviewed by	Approved by	Date	Revision Details
C01	██████ ██████	██████	██████	04/11/2022	Fit for acceptance
C02	████████████████████	██████	██████	16/11/2022	Fit for acceptance
C03	██████	██████ ██████	██████	15/02/2023	Fit for acceptance

Security classification: OFFICIAL

Handling Instructions: None

1.1 Design Review Form

- 1.1.1 This Design Review Form is a mandatory document required as part of the Design Review process defined in the Design Review Procedure (HS2-HS2-DS-PRO-000-000002).

Design Review Form:	2EW02-KIC-DS-REG-WS05-000035
Design Review Plan	2EW02-KIC-DS-PLN-A000-000002
Design Review Schedule	Refer to section 1.9.2. on the 2EW02-KIC-DS-PLN-A000-000002 and Clause 32 programme.

- 1.1.2 The Chairperson has the responsibility to fill in all the sections identified in this form.

Chairperson:	
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Design Review Type:	Interdisciplinary Design Review (IDR)
Design Review Title:	Tranche 1 Site 1 - Interdisciplinary Design Review (IDR) - Scheme Design
Design Review Topic(s):	Site 1 – M6 Slips and Yarnfield Lane (Highways)
Designer Organisation:	Kier
Customer:	HS2
Date:	02/11/2022
Location:	Microsoft Teams

1.2 Design Review Introduction

Design Stage:	Scheme Design
Purpose:	The purpose of this design review is to review all aspects of the design and allow a coordinated question and answer forum to allow discussion of the designs, risks, assumptions associated with the scheme.
Scope:	Provide brief description of the scope of this Design Review. • Technical - Scheme design development • Consultation • BIM • Environmental • Sustainability



- Buildability
 - Health and Safety
 - Interfaces
-

1.3 Design Review Attendees

1.3.1 Refer to Design Review Procedure (HS2-HS2-DS-PRO-000-000002).

Invited:

[illegible]

Key Discipline	Attendance		Name Provided	Organisation
	Mandatory	Optional		
Architecture		N		
Railway Systems		N		
Systems Integration		N	See technical assurance	
Health & Safety		Y	[REDACTED] [REDACTED]	Kier HS2
Operations & Maintenance	Y		[REDACTED] [REDACTED]	National Highways National Highways
Technical Assurance	Y		[REDACTED] [REDACTED]	Kier HS2
Requirements		N	[REDACTED]	HS2
BIM	Y		[REDACTED]	Kier
Stakeholders		Y	See civil engineering	See civil engineering
Customer		Y	[REDACTED]	Kier
Track		N		
Signalling		N		
Telecommunications		Y	[REDACTED]	Kier
Power (HV)		Y	[REDACTED]	Kier
Mechanical & Electrical (LV)		Y	[REDACTED]	Kier
Health Practitioners		Y	[REDACTED]	Park Health
Town Planning		Y	[REDACTED] [REDACTED] [REDACTED]	HS2 HS2 RPS
Additional (if necessary):				
Project Controls		N		
Costing		N		
Project Management	Y		[REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]	HS2 HS2 HS2 HS2 HS2 Kier Kier Kier

Key Discipline	Attendance		Name Provided	Organisation
	Mandatory	Optional		
			[REDACTED] - Chair	Kier
Risk Management	Y		Stated above	Stated above

Attendees:

Key Discipline	Attendance		Name Provided	Organisation
	Mandatory	Optional		
Environment	Y		██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████	Kier Kier Kier HS2 HS2 HS2 HS2
System Safety		N		
Civil Engineering	Y		██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████	RPS RPS RPS HS2 HS2 HS2 HS2 HS2 HS2 Kier Kier Kier Kier Kier Staffordshire CC Staffordshire CC Staffordshire CC
Architecture		N		
Railway Systems		N		

Key Discipline	Attendance		Name Provided	Organisation
	Mandatory	Optional		
Systems Integration		N		
Health & Safety		Y	[REDACTED] [REDACTED]	Kier HS2
Operations & Maintenance		N		
Technical Assurance	Y		[REDACTED] [REDACTED]	Kier HS2
Requirements	Y		[REDACTED] [REDACTED]	HS2 Kier
BIM		Y	[REDACTED] [REDACTED]	Kier Kier
Stakeholders		Y	See civil engineering and Operations & Maintenance.	See civil engineering and Operations & Maintenance.
Customer		Y	[REDACTED]	Kier
Track		N		
Signalling		N		
Telecommunications		N		
Power (HV)		N		
Mechanical & Electrical (LV)		N		
Health Practitioners		Y	[REDACTED]	Park Health
Town Planning		Y	[REDACTED] [REDACTED] [REDACTED]	HS2 HS2 RPS
Others		Y	[REDACTED] [REDACTED] [REDACTED] [REDACTED]	HS2 HS2 HS2 Kier
<i>Additional (if necessary):</i>				
Project Controls		N		
Costing		N		
Project Management	Y		[REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]	HS2 HS2 HS2 Kier Kier Kier

Key Discipline	Attendance		Name Provided	Organisation
	Mandatory	Optional		
			[REDACTED] - Chair	Kier
Risk Management	Y		[REDACTED]	HS2
			[REDACTED]	Kier
			[REDACTED]	Kier

1.4 Design Review Questionnaire

Subject	Question	Answer			Comments / Action(s)
		Yes	No	Date	
Previous Review	Are there any outstanding open issues from the previous Design Review?	x		01/11/22	Please refer to register 2EW02-KIC-DS-REG-WS05-000029 for comments. Please refer to the Interim IDC DRF (2EW02-KIC-DS-REG-WS05-000031). Please refer to the IDC DRF (2EW02-KIC-DS-REG-WS05-000033).
Issues and Actions	Have all issues been addressed and actions closed out?	x		01/11/22	Please refer to register 2EW02-KIC-DS-REG-WS05-000029 for list of closed comments. Some actions have been deferred to detailed design.
CDM	Have all the Designers Risk Register been signed off by the Designer and actions incorporated within the design?	x		01/11/22	Please refer to 2EW02-KIC-DS-REG-WS05-000025. The maturity is adequate for Scheme Design.
Environment	Have all the relevant environment requirements been complied with?	x		01/11/22	There is currently no known non-compliance. Please refer to EMR Compliance Note '2EW02-KIC-EV-NOT-WS05-000002'.

Subject	Question	Answer			Comments / Action(s)
		Yes	No	Date	
System Safety	Have all the system safety hazards been identified and recorded in the Hazards Log?		X	01/11/2022	Not applicable to the works package.

Civil Engineering	Depending on Design work package.	x		01/11/2022	Please refer to submitted documents through Projectwise. Scheme design is based on limited survey information and assumptions. See below the level of design at scheme design stage. • Alignment design - Based on partial topographical survey and assumptions • Drainage design - Based on partial GPR, topographical survey and assumptions • Earthworks design, Pavement design and Traffic Signs, Post & Foundation design – Based on partial topographical survey and assumptions only. No ground investigation survey available yet. These to be designed within LOD/LLAU The main constraint in this site is designing the works within the Limits of Deviation (LoD), however, the scheme is compliant with respect to LOD. The avoidance of steep gradients poses constraints to the extent of the widening. This has
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					been minimised by extending the existing crossfall of the carriageway into the widenings. Due to the constraints of the LOD to the south and the M6 overbridge to the north the alignment has to quickly climb up from the tie-in to the existing Yarnfield Lane up to the M6 structure resulting in a vertical grade of 5.51%. Therefore, a departure has been submitted, as this does not comply with the Max 5% gradient within 30m on cycle track - DMRB CD195 Table E3.9 & LTN 1/20 Table 5-8. Please refer to EW-263 to understand the level of detail included in scheme design in relation to the surveys. A cut-off date for the scheme design surveys was agreed on the 30th June 2022 and a track with the surveys completed at the point is included. Each site differs in risk in terms of missing survey information, for example the location of services may change, or the alignment may need to change based on the topography survey. In addition, GI, detailed topographical survey, traffic counts and
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Subject	Question	Answer			Comments / Action(s)
		Yes	No	Date	
					drainage surveys that are to be undertaken during the detailed design phase are required to confirm the pavement foundation design, statutory undertakers diversions and the design of the vertical alignment.
Architecture	Depending on Design work package.		X	01/11/2022	Not applicable to the works package.
Railway Systems	Depending on Design work package.		X	01/11/2022	Not applicable to the works package.
Systems Integration	Are all system integration aspects and activities defined and documented?		X	01/11/2022	Not applicable to the works package.
Interfaces	Have all interfaces been identified and recorded in the Interface Control Matrix?	x		01/11/22	Interfaces are recorded in the register '2EW02-KIC-DS-REG-WS05-000023'.
Departures	Have all departures been identified, recorded and accepted by HS2?		x	01/11/2022	Departures have been submitted to HS2 and are recorded in Tranche 1 – Site 1 – M6 Slips and Yarnfield Lane Departures register '2EW02-KIC-DS-REG-WS05-000024'.

Subject	Question	Answer			Comments / Action(s)
		Yes	No	Date	
					No formal submission to NH and/or SCC although they have been discussed at a high level to understand any major concerns. '2EW02-KIC-DS-REG-WS05-000024'. Departures from requirements have been recorded in the register "Departures register for requirements 2EW02-KIC-DS-REG-A000-000023"

Subject	Question	Answer			Comments / Action(s)
		Yes	No	Date	
Health & Safety	Have health and safety requirements been complied with?	x		01/11/22	Please refer to the Highways Design Report (HDR) '2EW02-KIC-HW-REP-WS05-000003'. Occupational Health and Wellbeing Management Plan (2EW02-KIC-HS-PLN-A000-000005) Health Hazard Evaluation and Mitigation Plan (2EW02-KIC-HS-PLN-A000-000006) Safety Management Plan (2EW02-KIC-HS-PLN-A000-000007) Incident Management Plan (2EW02-KIC-HS-PLN-A000-000002) For more information on how the H&S requirements have been complied, please refer to the section 2.11 in the Design Assurance Report (Document no: 2EW02-KIC-DS-REP-A000-000007)
Requirements	Have all the relevant requirements been complied with?	x		01/11/22	Please refer to the Highways Design Report (HDR) '2EW02-KIC-HW-REP-WS05-000003' and

Subject	Question	Answer			Comments / Action(s)
		Yes	No	Date	
					the VVM register '2EW02-KIC-DS-REP-A000-000002'.
Assumptions	Have all the assumptions related to this design review been captured and noted?	x		01/11/22	Please refer to the assumptions register '2EW02-KIC-DS-REG-WS05-000026'.
BIM	Have models and supporting data been validated and provided?	x		01/11/22	All drawings have been produced in accordance with the TIDP and submitted through the CDE - (Projectwise). Refer to the BEP (2EW02-KIC-IM-PLN-A000-000002) and MPDT (2EW02-KIC-IM-PLN-A000-000022)
Operations & Maintenance	Are the impacts to Operations and Maintenance identified, recorded and agreed with the relevant Ops and Maintenance Reps?	X		01/11/2022	National Highways and Staffordshire CC will be maintaining the assets in the long term.
Technical Standards	Have all the relevant Technical Standards been identified and complied with?	x		01/11/22	Please refer to the Highways Design Report (HDR) '2EW02-KIC-HW-REP-WS05-000003' and the standards record '2EW02-KIC-DS-REG-A000-000025'.

1.5 Design Review Pack

1.5.1 Typical pack contents may include:

- Previous Design Review Report;
- Design Review Action Register from previous reviews;
- Previous eB comment sheets;
- Version of PRS or CRT applicable to the design under review;
- Applicable engineering data (e.g. calculations, simulations, analysis, test results, etc.);
- BIM Models, drawings, layouts, mock-ups and prototypes;
- Risk analysis (identified and recorded);
- Cost and schedule status and projections;
- Description of unusual requirements and design elements with associated high-risk;
- Assumptions identified, recorded and agreed;
- Departures from Technical Standards identified, recorded and agreed.

Tranche 1 Site 1 – Interdisciplinary Design Review (IDR) Form – Scheme Design

Document no: 2EW02-KIC-DS-REG-WS05-000035

Revision: C03

Item No.	eB Document Number	eB Revision	eB Document
1	2EW02-KIC-DS-REG-WS05-000029	C01	Interim IDC, IDC, IDR Action Register
2	2EW02-KIC-DS-REG-WS05-000031	C01	Interim IDC (I-IDC) Form
3	2EW02-KIC-DS-REG-WS05-000033	C01	IDC Form
4	2EW02-KIC-DS-REG-WS05-000035	C01	IDR Form (this document)
5	2EW02-KIC-HW-REP-WS05-000003	C02	Highways Design Report (HDR)
6	2EW02-KIC-DS-REG-WS05-000024	C01	Departures Register
7	2EW02-KIC-HW-DPL-WS05-000242	C01	Site 1 - Departures From Standards Location Plan
8	2EW02-KIC-DS-REG-A000-000023	C02	Departures register for requirements
9	2EW02-KIC-DS-REG-WS05-000025	C02	CDM Register
10	2EW02-KIC-DS-REG-WS05-000026	C02	Assumptions Register

Tranche 1 Site 1 – Interdisciplinary Design Review (IDR) Form – Scheme DesignDocument no: **2EW02-KIC-DS-REG-WS05-000035**Revision: **C03**

Item No.	eB Document Number	eB Revision	eB Document
11	2EW02-KIC-IM-PLN-A000-000001	C03	Master Information Delivery Plan (MIDP)
12	2EW02-KIC-IM-PLN-A000-000022	C02	Model Production Delivery Table (MPDT)
13	2EW02-KIC-DS-REP-A000-000002	C02	Verification and Validation Matrix
14	2EW02-KIC-DS-REG-A000-000025	C02	Standards Baseline Register
15	2EW02-KIC-HW-DLO-WS05-000003	C01	Site 1 - Location Plan Yarnfield Lane - M6 Sliproads
16	2EW02-KIC-HW-DPL-WS05-000012-16 and 147-149	C01	Site 1 – Scheme Site Extents
17	2EW02-KIC-HW-DPL-WS05-000209	C01	Site 1a – Scheme Site Extents
18	2EW02-KIC-HW-DPL-WS05-000215-221	C01	Site 1 – Highways Boundary
19	2EW02-KIC-HW-DPL-WS05-000214	C01	Site 1a – Highways Boundary

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Item No.	eB Document Number	eB Revision	eB Document
20	2EW02-KIC-HW-DPP-WS05-000001	C01	Site 1 - Geometric Plan and Profile – Yarnfield Lane Sheet 1
21	2EW02-KIC-HW-DPP-WS05-000002	C01	Site 1 - Geometric Plan and Profile – Yarnfield Lane Sheet 2
22	2EW02-KIC-HW-DPL-WS05-000194	C01	Site 1 - Geometric Plan and Profile – M6 Northbound Diverge
23	2EW02-KIC-HW-DPL-WS05-000195	C01	Site 1 - Geometric Plan and Profile – M6 Northbound Merge
24	2EW02-KIC-HW-DPP-WS05-000004	C01	Site 1 - Geometric Plan and Profile – M6 Southbound Diverge
25	2EW02-KIC-HW-DPP-WS05-000005	C01	Site 1 - Geometric Plan and Profile – M6 Southbound Merge Sheet 1
26	2EW02-KIC-HW-DPP-WS05-000006	C01	Site 1 - Geometric Plan and Profile – M6 Southbound Merge Sheet 2
27	2EW02-KIC-HW-DPP-WS05-000007	C01	Site 1 - Geometric Plan and Profile – M6 Access Road

Tranche 1 Site 1 – Interdisciplinary Design Review (IDR) Form – Scheme DesignDocument no: **2EW02-KIC-DS-REG-WS05-000035**Revision: **C03**

Item No.	eB Document Number	eB Revision	eB Document
28	2EW02-KIC-HW-DPP-WS05-000008	C01	Site 1 - Geometric Plan and Profile – Farm Access
29	2EW02-KIC-HW-DPP-WS05-000009	C01	Site 1 - Geometric Plan and Profile – Pond Access
30	2EW02-KIC-HW-DPP-WS05-000013	C01	Site 1a - Geometric Plan and Profile
31	2EW02-KIC-HW-DPP-WS05-000010	C01	Site 1 – Phase 2 - Geometric Plan and Profile – M6 Southbound Merge Sheet 1
32	2EW02-KIC-HW-DPP-WS05-000011	C01	Site 1 – Phase 2 - Geometric Plan and Profile – M6 Southbound Merge Sheet 2
33	2EW02-KIC-HW-DPP-WS05-000012	C01	Site 1 – Phase 2 - Geometric Plan and Profile – Northbound Emergency access slip
34	2EW02-KIC-HW-DDE-WS05-000028-48	C01	Site 1 Cross Sections
35	2EW02-KIC-HW-DPL-WS05-000233-234	C01	Site 1a - Cross Sections
36	2EW02-KIC-HW-DSE-WS05-000007-08	C01	Site 1 – Typical Cross Sections
37	2EW02-KIC-HW-DSE-WS05-000245	C01	Site 1a – Typical Cross Sections

Tranche 1 Site 1 – Interdisciplinary Design Review (IDR) Form – Scheme Design

Document no: **2EW02-KIC-DS-REG-WS05-000035**

Revision: **C03**

Item No.	eB Document Number	eB Revision	eB Document
38	2EW02-KIC-HW-DPL-WS05-000223-230	C01	Site 1 – Vehicle Tracking
39	2EW02-KIC-HW-DPL-WS05-000231	C01	Site 1a – Vehicle Tracking
40	2EW02-KIC-HW-DPL-WS05-000007-11 and 144-146	C01	Site 1 – Site Clearance
41	2EW02-KIC-HW-DPL-WS05-000210	C01	Site 1a – Site Clearance
42	2EW02-KIC-HW-DPL-WS05-000017-21 and 150-152	C01	Site 1 – Fencing Layout
43	2EW02-KIC-HW-DPL-WS05-000204	C01	Site 1a – Fencing Layout
44	2EW02-KIC-HW-DPL-WS05-000022-26	C01	Site 1 -RRS
45	2EW02-KIC-HW-DPL-WS05-000027-31 and 153-155	C01	Site 1 – Drainage Layout
46	2EW02-KIC-HW-DPL-WS05-000202	C02	Site 1a – Drainage Layout

Tranche 1 Site 1 – Interdisciplinary Design Review (IDR) Form – Scheme Design

Document no: **2EW02-KIC-DS-REG-WS05-000035**

Revision: **C03**

Item No.	eB Document Number	eB Revision	eB Document
47	2EW02-KIC-HW-DPL-WS05-000045-49 and 198-201	C01	Site 1 – Earthworks Plan and Profile
48	2EW02-KIC-HW-DPL-WS05-0000196 and 197	C02	Site 1 – Earthworks Plan and Profile
49	2EW02-KIC-HW-DPL-WS05-000203	C02	Site 1a – Earthworks Plan and Profile
50	2EW02-KIC-HW-DPL-WS05-000190-193	C01	Site 1 - Standard Earthworks Details
51	2EW02-KIC-HW-DPL-WS05-000050-54 and 156-158	C01	Site 1 – Pavement Layout
52	2EW02-KIC-HW-DPL-WS05-000207	C01	Site 1A - Pavement Layout
53	2EW02-KIC-HW-DPL-WS05-000057, 59, 159 and 160	C01	Site 1 - Kerbs, Footways, Cycleways and Paved Area
54	2EW02-KIC-HW-DPL-WS05-000205	C01	Site 1a - Kerbs, Footways, Cycleways and Paved Area
55	2EW02-KIC-HW-DPL-WS05-000069-73 and 165-167	C01	Site 1 – Road Markings

Tranche 1 Site 1 – Interdisciplinary Design Review (IDR) Form – Scheme DesignDocument no: **2EW02-KIC-DS-REG-WS05-000035**Revision: **C03**

Item No.	eB Document Number	eB Revision	eB Document
56	2EW02-KIC-HW-DPL-WS05-000208	C01	Site 1a – Road Markings
57	2EW02-KIC-HW-DPL-WS05-000060, 61, 63, 64 and 162-164	C01	Site 1 – Traffic Signs Layout
58	2EW02-KIC-HW-DPO-WS05-000062	C01	Site 1 – Traffic Signs Layout
59	2EW02-KIC-HW-DPL-WS05-000212	C01	Site 1a – Traffic Signs Layout
60	2EW02-KIC-HW-DDE-WS05-000007-08	C01	Site 1 – Traffic Signs Details
61	2EW02-KIC-HW-DDE-WS05-000020	C01	Site 1a – Traffic Signs Details
62	2EW02-KIC-HW-DPL-WS05-000079-82	C01	Site 1 – Motorway Communications
63	2EW02-KIC-HW-DPL-WS05-000083-87, 89, 168 and 170	C01	Site 1 – Landscaping and Ecology
64	2EW02-KIC-HW-DPL-WS05-000206	C01	Site 1a – Landscaping and Ecology
65	2EW02-KIC-HW-DPL-WS05-000088-92 and 171-173	C01	Site 1 - Statutory Undertakers Apparatus

Tranche 1 Site 1 – Interdisciplinary Design Review (IDR) Form – Scheme Design

Document no: **2EW02-KIC-DS-REG-WS05-000035**

Revision: **C03**

Item No.	eB Document Number	eB Revision	eB Document
66	2EW02-KIC-HW-DPL-WS05-000211	C01	Site 1a - Statutory Undertakers Apparatus
67	2EW02-KIC-DS-REP-A000-000002	C02	Verification and Validation Matrix
68	2EW02-KIC-DS-REG-A000-000025	C02	Record of Standards
69	2EW02-KIC-DS-REG-A000-000023	C02	Departures registers for requirements

1.6 **Design Review Action Register**

1.6.1 Please refer to Design Review Action Register template [HS2-HS2-DS-TEM-000-000012](#).

Design Review Action Register	2EW02-KIC-DS-REG-WS05-000029
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1.7 RRAIDD Summary

1.7.1 Details of any Omissions or Exclusions: *Provide brief summary of any omissions or exclusion from this RRAIDD.*

RRAIDD	Referenced Source or Statement of current position	Current Status; - Complete (C), - Partial (P), - Not Started (NS)	Action & Completion Date
Requirements	2EW02-KIC-DS-REP-A000-000002 Tranche 1 - Verification and Validation Matrix	<i>P</i>	VVM needs to be resubmitted for acceptance. C03 needs to be issued. Departures from requirements (2EW02-KIC-DS-REG-A000-000023) needs to be resubmitted for acceptance. C03 needs to be issued. Departure from CRT Requirement P2a-ECW2.194 ID 2EW02_KIC-RFI_OUT-0000423 is still outstanding.
Risks	2EW02-KIC-DS-REG-WS05-000025 Tranche 1 - CDM Risk Register	C (C01)	<i>CDM risk register has been accepted for scheme design.(Code 1)</i>
Assumptions	2EW02-KIC-DS-REG-WS05-000026	C (C01)	<i>Assumptions have been</i>

	Tranche 1 - Site 1 Assumptions Register		<i>accepted for scheme design.(Code 2)</i>
Interfaces	2EW02-KIC-DS-REG-WS05-000023 Tranche 1 - Interface Register	C (C01)	<i>Interface register has been accepted Code 1 and relatics have been progressed to a level acceptable for scheme design.</i>
Dependencies	N/A	n/a	<i>See Action List</i>
(Design) Deliverables	2EW02-KIC-IM-PLN-A000-000001 C03 MIDP 2EW02-KIC-IM-PLN-A000-000022 C01 MPDT	P	<i>Drawings have been coded 2 accepted.</i> <i>MPDT has been code 1 accepted.</i> <i>MIDP is waiting to be coded and it needs to be code 1.</i>

1.8 Design Review Close Out

1.8.1 Action/Query Class Explanation

- **Level 1** – Immediate Actions to be cleared – these actions require mitigating/clearing before the design moves onto the next stage or can be signed off for acceptance. (i.e. L3 Date).
- **Level 2** – Actions to be recorded and noted – these actions require to be recorded at this stage by the Designer for inclusion into future stages or design revisions.

1.8.2 The Chairperson is required to provide responses to the following Questions and if applicable a declaration of completion of the Design Review.

1	Are there any L1 Actions arising from Questionnaire (section 1.4)?	No
2	Are there any L1 Actions arising from Action Register (section 1.6)?	No
3	Actions Cleared - Design Review completed.	All the actions for the scheme design have been completed and actions that remain open are to be deferred to Detailed design. Refer to Site 1 Action Register 2EW02-KIC-DS-REG-WS05-000029.

1.9 Design Review Completion and Sign Off

1.9.1 The Design Review Sign Off is required to be referenced within the L3 Certificate.

1.9.2 The Sign Off will need to reflect the number of Design Reviews identified in the **Design Review Plan** for a particular Design work package.

Design Review Plan	2EW02-KIC-DS-PLN-A000-000002	21/04/2022
Design Review 1	I-IDC	21/04/2022
Design Review 2	IDC	21/09/2022
Design Review 3	IDR	02/11/2022

1.9.3 The signed off Design Review Form will form part of the evidence provided within the Design Review Report referenced within the L3 Certificate.

	Name	Signature	Date
Chairperson			- 16/11/2022
Designer			02/11/2022

HS2

Phase 2a Enabling Civil Works (ECW2)

Site 1 - Highways Design Report

Yarnfield Lane – M6 Sliproads

Document no: 2EW02-KIC-HW-REP-WS05-000003

Revision	Author	Reviewed by	Approved by	Date approved	Reason for revision
C01	■	■	■	20.10.22	For Acceptance
C02	■	■	■	23.12.22	For Acceptance

Security classification: OFFICIAL

Handling Instructions: enter handling instructions here

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1 Executive Summary

- 1.1.1 The proposed project is currently at Stage 3: Scheme Design and Consents, in the Stage Gate process. It will continue to detailed design and construction.
- 1.1.2 This Highways Design Report (HDR) summarises the infrastructure design of the Yarnfield Lane works that forms part of the HS2 Phase 2a Enabling Civil Works (ECW2) contract package.
- 1.1.3 The Yarnfield Lane works comprises the realignment of Yarnfield Lane, associated replacement M6 overbridge structure, and the provision of slip roads to the M6 motorway in both directions. The scope of Site 1 also includes the provision of accommodation accesses, the realignment of the Fillybrook watercourse and the provision of a cycle route between the proposed tie-ins with the existing Yarnfield Lane alignment, i.e. near to Victoria Cottage to the west and Darlaston Grange Cottages to the east. The above works are referred to within this report, and other associated drawings and reports, as Site 1.
- 1.1.4 The temporary widening at the eastern end of Yarnfield Lane to accommodate construction traffic is also included in this contract and is referred to within this report, and other associated drawings and reports, as Site 1a.
- 1.1.5 New permanent traffic signals are proposed to be included at the junction of Yarnfield Lane and the A34 The Fillybrooks, as mandated in the Environmental Statement (ES). The provision of new permanent traffic signals is not part of the scope of Site 1 or Site 1a and therefore no further discussion is provided on it within this report or any document associated with Site 1 or Site 1a.
- 1.1.6 The realignment of Yarnfield Lane is over a distance of 1.2km, 25m north-west of its current alignment, and includes the provision of a replacement bridge to carry Yarnfield Lane over the M6 (up to 9.6m in height above existing ground level). This enables the replacement overbridge to be operational concurrently with the existing Yarnfield Lane overbridge during construction, thus segregating construction traffic from public traffic on Yarnfield Lane. This results in safety improvements and reduced disruption to existing users of Yarnfield Lane. The proposed replacement overbridge will allow for future widening of the M6 motorway. Permanent access is provided to and from the Stone IMB-R from Yarnfield Lane and the M6 southbound carriageway via slip roads.
- 1.1.7 Permanent maintenance and emergency access to the northbound lanes of the M6 from the realigned Yarnfield Lane are provided. During construction these would

provide temporary access for construction traffic, which would then cross to the Stone IMB-R site via the Yarnfield Lane M6 overbridges.

1.1.8 This Highway Design Report (HDR) takes into consideration of design elements include:

- Highways Alignment
- Site Clearance
- Fencing and Accommodation Works
- Road Restraint Systems
- Drainage and Service Ducts
- Earthworks
- Pavements
- Kerbs, Footways & Paved Areas
- Traffic Signs & Road Markings
- Motorway communications (NH infrastructure)
- Landscaping
- Utilities

1.1.9 Please refer to the Site 1 – Scheme Design TIDP (2EW02-KIC-IM-PLN-WS05-000003) for the references of all the associated scheme design drawings.

1.1.10 Initial consideration is given to the constructability, traffic management and other facets of the construction works, which will be addressed in more detail as part of the subsequent detailed design phase.

1.1.11 The works undertaken on the procedural aspects of the Scheme Design including Stakeholder Consultation, Road Safety Audits, Departure from Standards, Undertakings & Assurances (U&As) and CDM are also outlined.

2 Introduction

2.1 Project/ Work Package Description

2.1.1 This Highways Design Report (HDR) summarises the infrastructure design of the Yarnfield lane works Enabling Civil Works (ECW2) package. This package covers the design, pre-construction, enabling works and construction works.

2.1.2 The proposed scope of the design of the Site 1 and Site 1a works are summarised below:

- Yarnfield Lane realignment;
- Hydraulic assessment of the Filly Brook flood plain prior to the completion of all HS2 main civils works in this area i.e. Yarnfield Lane and IMB-R and subsequent construction of any required hydraulic features;
- M6 southbound slip roads (IMB-R and emergency access) – arrangement during HS2 construction;
- M6 southbound slip roads (IMB-R and emergency access) – permanent arrangement;
- M6 southbound slip road junction–arrangement during HS2 construction remains permanent;
- M6 northbound slip roads (IMB-R and emergency access) – arrangement during HS2 construction;
- M6 northbound slip road roundabout – arrangement during HS2 construction;
- M6 northbound emergency access – permanent arrangement;
- Interface with National Highways, and the design of like for like replacement, for any associated modifications to the M6 and All Lane Running technology infrastructure, NRTS (National Roads Telecommunications Service);
- Stone rural footpath 33 temporary realignment over affected portion;
- Yarnfield Lane M6 Overbridge Replacement Structure (this is not covered in this HDR but in the structures HDR);
- Highway (Yarnfield Lane and M6) drainage design;
- Highway (Yarnfield Lane) drainage pond;
- Highway (Yarnfield Lane and M6) culvert extensions;
- Utilities works;
- Permanent access to Whitemoor Farm;
- Temporary access provision and utility connections maintained to Pool House Farm;
- Any associated changes with HE M6 ALR scheme due to HS2 ECW2 works;
- Changes to signing and lining as per proposed design;
- Design and agreement of field accesses;

- Protection or diversion of utility asset owners apparatus and assets as required;
- Provision for future utility connections to compound, so as to avoid disturbance of the works constructed under this work scope;
- Yarnfield Lane (east) widening (Site 1a) - arrangement during HS2 construction.

2.1.3 The design of the Site 1 and Site 1a is being undertaken in accordance with Assurance U&A_593.



Figure 1: Location Plan

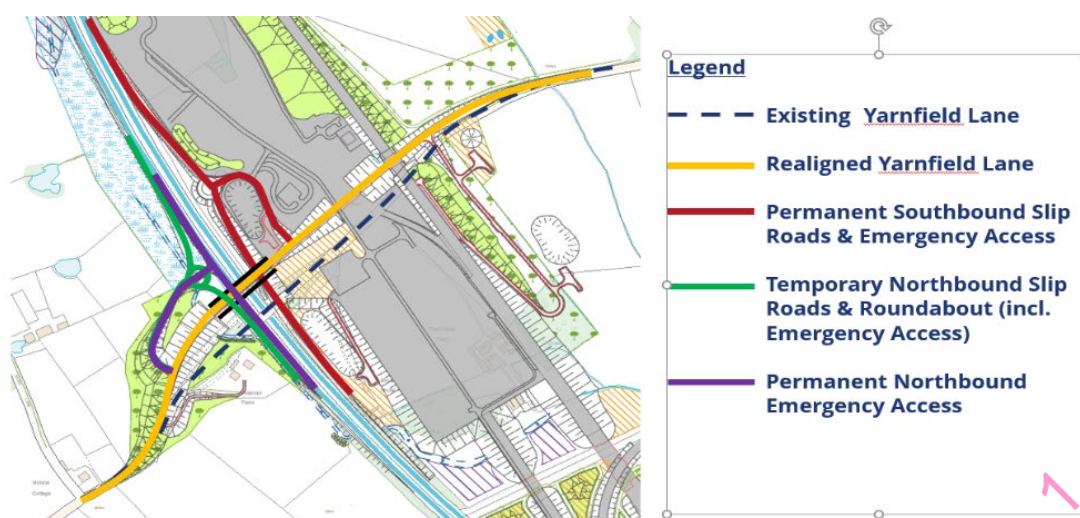


Figure 2: Proposed Permanent Arrangement and Arrangement During Construction of HS2 at Yarnfield Lane

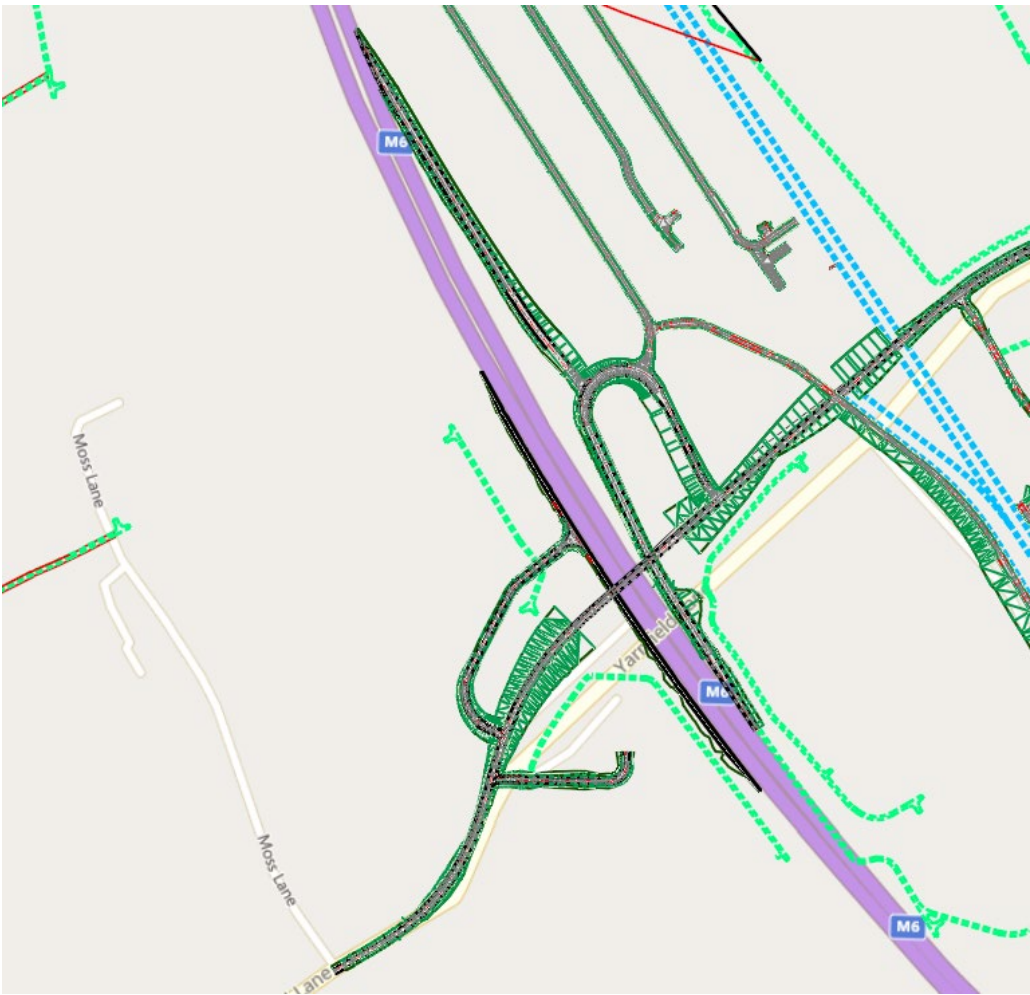


Figure 3: Proposed Permanent Arrangement of Yarnfield Lane

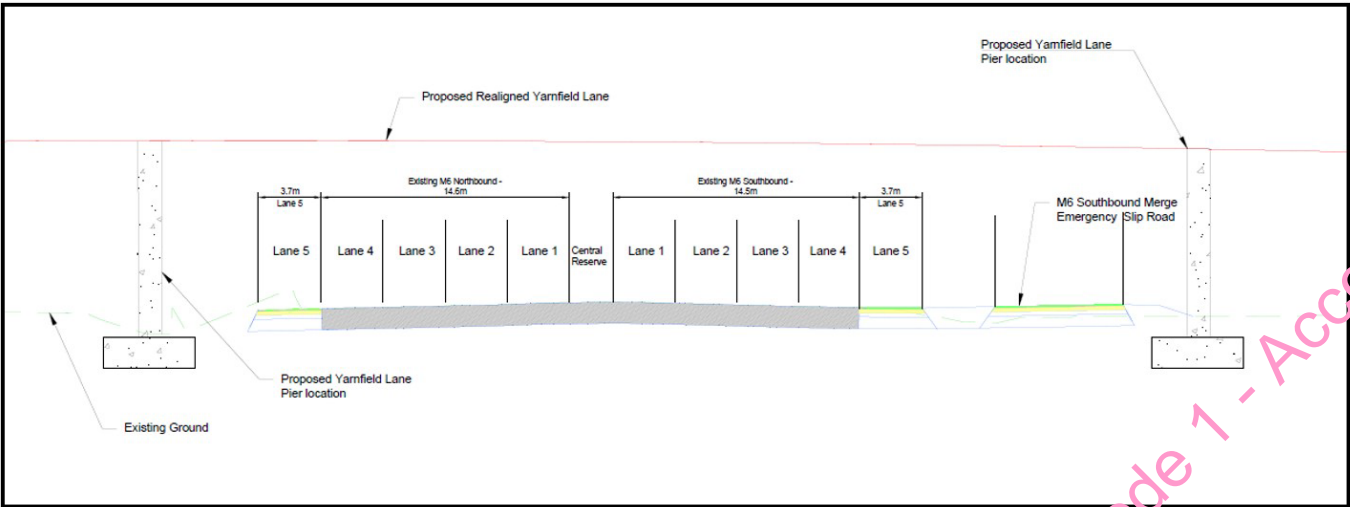


Figure 4: Futureproofing for D5 ALR

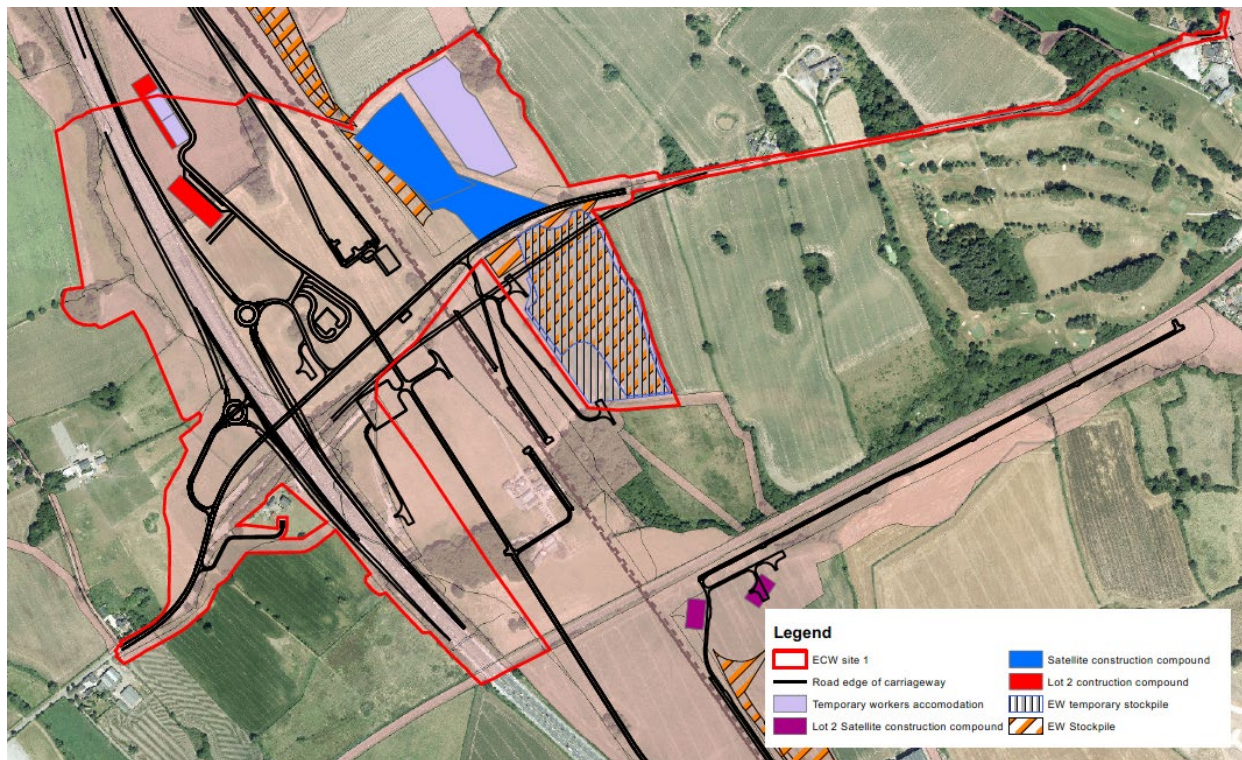


Figure 5: Site Boundary for Site 1 and Site 1a (ECW2 Scope of Work. Note AP2 design is included in background of image)



Figure 6: Extents of works of Site 1a

2.2 Description of Route

- 2.2.1 The proposed realigned Yarnfield Lane is a 1.2km long, 6.8m wide, single carriageway that ties into the existing Yarnfield Lane either side of the M6. The realigned carriageway is located 25m north-west of its current alignment. The realignment includes the provision of a proposed M6 bridge replacement.
- 2.2.2 An emergency access is proposed for emergency and maintenance use by National Highways and blue light emergency services, for the permanent arrangement, on the northbound M6 carriageway to replace the existing facility which connects to the proposed realigned Yarnfield Lane. The proposed emergency access lane is 5.5m with 1.5m verges and connects the northbound M6 carriageway to the proposed realigned Yarnfield Lane.
- 2.2.3 The Stone IMB-R is accessed from the southbound carriageway of the M6 motorway via a proposed 3.7m wide diverge slip road with hard shoulders (3.3 left and 1.0m right). The proposed diverge slip connects to a proposed junction to the proposed IMB-R Connector Road, that links into the proposed IMB-R internal access network and the proposed realigned Yarnfield Lane, and the proposed M6 southbound merge slip. Vehicles leaving the IMB-R can therefore also access the M6 southbound carriageway via the proposed M6 southbound merge slip road. The proposed southbound M6 merge slip road is 3.7m wide with hard shoulders (3.3 left and 0.7 right) and verge connect the M6 southbound lane.
- 2.2.4 The southbound arrangement, from the M6 to the proposed realigned Yarnfield Lane will be for IMB-R access and emergency use only and will not be available for public use. The means of ensuring public cannot utilise this arrangement (through enforcement or otherwise) is outside of the scope of this contract and is to be agreed between HS2 Ltd., National Highways (NH) and Staffordshire County Council (SCC).
- 2.2.5 The temporary widening (during the construction of HS2) of Yarnfield Lane (east) associated with Site 1a is located as shown in Figure 6. Consideration has been given to the need to reduce both loss of woodland and the impact on the golf course. To achieve this, the road is proposed to be widened on the south side, as it passes adjacent to woodland, and on the north side as it passes the golf course.

2.3 Local Highway Authority

2.3.1 The Staffordshire County Council is the local highways authority.

Staffordshire County Council (SCC)

1 Staffordshire Place,
Stafford,
Staffordshire,
ST16 2DH

3 Principal Engineering Details

3.1 Design Basis

3.1.1 The key Technical Standards referred to in these works are as follows:

- HS2 Technical Standard – Roads (ref. HS2-HS2-HW-STD-000-000001);
- Highway and Access Drainage Technical Standard (ref. HS2-HS2-DR-STD-000-000002);
- Fencing Technical Standard (ref. HS2-HS2-CV-STD-000-000002);
- Fencing Standard Details (ref. HS2-ARP-CV-DDE-000-0003xxx series);
- HS2 Standard Details;
- Staffordshire County Council Base Specification V1.3;
- SCC Standard Details;
- Manual of Contract Documents for Highways; Works Volume 1: Specification for Highways Works;
- Design Manual for Roads and Bridges;
- The Traffic Signals Manuals;
- The Traffic Signs Regulations and General Directions 2016; and
- Requirements and commitments made by the Employer as well as recognised industry best practice.

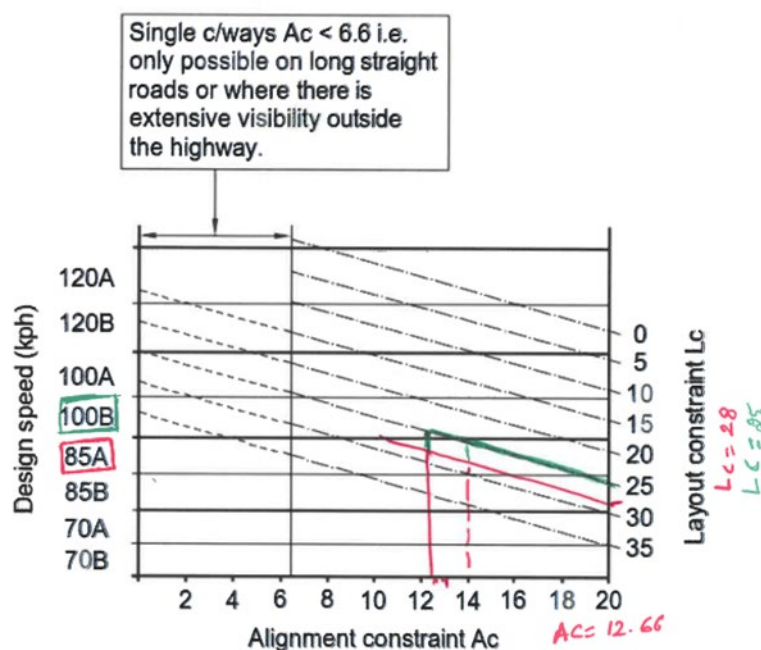
3.2 Design Speed

3.2.1 The following clauses taken from HS2 Technical Standard – Roads were considered in the selection of the design speed for Yarnfield Lane:

- 6.2.2 Unless otherwise specified in Appendix A, roads designed to the design basis 'As Existing' shall match the standards of the adjacent road
- 6.3.1 The design basis 'DMRB' (Design Manual for Roads and Bridges) is applicable for the design of all motorway and all- purpose trunk roads, unless an 'As Existing' design basis is agreed with National Highways for small scale works at a particular site
- 6.3.2 Some local highway authority 'A' roads built to modern standards may also adopt the 'DMRB' design basis. However, local circumstances may mean that the 'HS2 rural road design criteria' on the HS2 urban street design criteria' may be more appropriate.
- Appendix B – HS2 urban street design criteria
- B.6.4 For urban streets with a design speed greater than 60kph, horizontal radii shall be in accordance with DMRB standard CD109
- Appendix C – HS2 rural road design criteria

- C.1.3 The HS2 rural road design criteria draw guidance and requirements from Manual for Street and Manual for Streets 2 (particularly for lower-speed rural roads), the DMRB (particularly for rural roads with a design speed greater than 60kph) and experience from the Channel Tunnel Link (CTRL) project (now known as High Speed One, HS1)
- C.6.23 The selection of an appropriate design speed is critical in designing rural roads that retain the 'feel' of other rural roads in the locality. Each design speed has engineering standards associated with it (such as alignment and cross-fall), and the selection of a greater speed than necessary may result in a rural road appearing 'over-engineered' and not in-keeping with its surroundings.
- C.6.24 For existing rural roads with an 85th percentile speed greater than 40 mph, the design speed shall be selected using DMRB standard CD109.

3.2.2 In lieu of any speed survey data, a Design speed of 85kph has been selected for Yarnfield Lane as per CD109, Clause 2.1, based upon the following calculations:



- Alignment constraint (A_c) can be calculated using Equation 2.2b for single carriageways.

Equation 2.2b Single carriageways

$$Ac = 12 - \frac{VISI}{60} + \frac{2B}{45}$$

where:

B = Bendiness degrees / km.

VISI = Harmonic mean visibility (metres) (see harmonic mean visibility section below).

- The harmonic mean visibility for new roads should be calculated using Equation 2.8.1., CD109.

Equation 2.8.1 Formula for calculating harmonic mean visibility

$$VISI = \frac{n}{\frac{1}{V_1} + \frac{1}{V_2} + \frac{1}{V_3} + \dots + \frac{1}{V_n}}$$

where:

n = Number of observations.

V₁ = Sight distance at point 1, etc.

- The harmonic mean visibility for existing roads can be calculated using an empirical relationship equation.

$$\text{Log}_{10} VISI = 2.46 + \frac{VW}{25} - \frac{B}{400}$$

where:

VW = Average verge width (averaged for both sides of the road)

B = Bendiness (degree per km - minimum length of 2 km)

- As per CD109, Clause 2.8.3 for preliminary route analysis, where detailed measurements of sight distance are not available, the following typical values can be used:
 - VISI = 700 metres for long virtually straight roads, or where the road is predominantly on embankment affording high visibility across embankment slopes or adjoining level land.
 - VISI = 500 metres where a new road is designed with continuous overtaking visibility, with large crest K values and wide verges for visibility.
 - VISI = 300 metres where a new road is designed with frequent overtaking sections but with stopping sight distance provision at all sharp curves.
 - VISI = 100 - 200 metres where an existing single carriageway contains sharp bends, frequent double white line sections and narrow verges.
- Harmonic mean visibility is considered 200m.

- Bendiness can be calculating from dividing the sum of the change in direction (in degrees) of a road by the length (in km) over which it occurs.
- Bendiness is 89.9, sum of degrees 43.782+32.724+31.44 divided by length of the road 1.2km.
- Alignment constraint (Ac) is 12.66 for the bendiness 89.9 and Harmonic mean visibility 200m.
- Layout constraint (Lc) is 28 obtained from CD109, Table 2.3 with consideration s2 type of Road i.e., 6m carriageway width and 1.5m verge.

- The proposed design speed achieved is **85A**.
- Alignment constraint (Ac) is 14.32 for the bendiness 89.9 and reduced Harmonic mean visibility 100m.
- The proposed design speed achieved is **85A** for the 6.8m carriageway width and 1.5m verge. For the Assumed Harmonic mean visibility 100 or 200, the proposed design speed is still same 85A.
- Where consideration S2 type of Road 7.3m carriageway width and 1.5m verge, the layout constraint (Lc) is 25.
- The proposed design speed achieved is **100B** for the 7.3 carriageway width and 1.5m verge.
- The proposed design speed achieved is **85A** for the 7.3 carriageway width and 1.5m verge with 100m Harmonic mean visibility.
- M6 Slips - 70kph.
- M6 Slips emergency access connector road - 30kph.
- Whitemoor Farm Access - 30kph.

3.3 Existing Topographical Setting and Terrain

- 3.3.1 The topography of the site is relatively flat.
- 3.3.2 The existing topography at the proposed location of the realigned Yarnfield Lane is rural in nature, surrounded by agricultural tree and hedge lined fields. Whitemoor Farm, Poolhouse Farm and Brookhouse Farm are all to the south of Yarnfield lane.
- 3.3.3 The results of the archaeology survey are not yet currently available.

4 Highway Alignment

4.1 General Conditions

- 4.1.1 The existing Yarnfield Lane is to be realigned as per HS2 proposed works. It will cross through agricultural land and several public rights of way road.

4.2 Existing Horizontal Profile

- 4.2.1 The existing Yarnfield Lane alignment lies generally in a south-west to north-east direction, is made up of a continuous series of small reverse curves and crosses the M6 via an overbridge.

4.3 Proposed Horizontal Profile

- 4.3.1 Yarnfield Lane is described from south-west to north-east starting at chainage 29.87m to 2083.78m. Chainage 0.00m is taken perpendicular to the junction with Moss Lane to the south.
- 4.3.2 The extent of Yarnfield Lane Site 1 is from chainage 29.87m to 1203.630m, including the horizontal realignment of the road. The extent of Yarnfield Lane Site 1A is from chainage 1716m to 2083.78m, including the carriageway widening to both the left- and right-hand sides.
- 4.3.3 The proposed Yarnfield Lane realignment crosses the M6 approximately 60m north-west of the existing overbridge, at approximate chainage 500m.
- 4.3.4 The alignment starts on a straight element, followed by a reverse curve with a measured radius of R=180m and R=255 respectively. This is equivalent to a three-step relaxation for first 180m curve and two step relaxation for the second curve 255m to the relative 85kph design speed. As this bend is sub-standard for the given design speed, the calculated theoretical transition length is $\sqrt{24R} = 65.7\text{m}$ and 78.2m in accordance with Cl.4.15 of CD109. The alignment ties in to the existing Yarnfield Lane on a straight element to the north after a 510m radius curve preceded and followed by 100m transitions curves.
- 4.3.5 The proposed horizontal geometry of Yarnfield Lane, associated side roads and slip roads is provided in the tables below.

Table 1: Proposed Horizontal Geometry of Yarnfield Lane

Yarnfield Lane		85kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Start	End					
0+000.00m	0+001.31m	Line		1.308m		Existing Yarnfield Lane horizontal alignment
0+001.31m	0+005.73m	Line		4.424m		
0+005.73m	0+017.33m	Line		11.602m		
0+017.33m	0+027.79m	Line		10.455m		
0+027.79m	0+029.87m	Line		2.081m		
0+029.87m	0+095.57m	Transition		65.700m		
0+095.57m	0+166.86m	Curve	180.000m	71.285m	510m	Three steps below des. min.
0+166.86m	0+232.56m	Transition		65.700m		
0+232.56m	0+240.89m	Line		8.333m		
0+240.89m	0+319.09m	Transition		78.200m		
0+319.09m	0+386.53m	Curve	255.000m	67.441m	510m	Two steps below des. min.
0+386.53m	0+464.73m	Transition		78.200m		
0+464.73m	0+807.79m	Line		343.065m		
0+807.79m	0+917.79m	Transition		110.000m		
0+917.79m	1+093.60m	Curve	510.000m	175.801m	510m	
1+093.60m	1+203.60m	Transition		110.000m		
1+203.630m	1+204.782m	Line		1.187m		Existing Yarnfield Lane horizontal alignment. Phase 1A extent starts at Ch.1+716m
1+204.782m	1+215.189m	Curve	720.000m	10.407m	510m	
1+215.189m	1+306.226m	Line		91.037m		
1+306.226m	1+311.309m	Curve	1440.000m	5.083m	510m	
1+311.309m	1+607.698m	Line		296.389m		
1+607.698m	1+928.730m	Line		321.033m		

Yarnfield Lane		85kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Start	End					
1+928.730m	1+976.894m	Transition		48.163m		Existing Yarnfield Lane horizontal alignment. Phase 1A extent starts at Ch.1+716m
1+976.894m	2+015.301m	Curve	105.008m	38.407m	510m	
		Transition		0.000m		
2+015.301m	2+033.004m	Line		17.704m		
		Transition		0.000m		
2+033.004m	2+054.117m	Curve	94.563m	21.113m	510m	
2+054.117m	2+083.783m	Transition		29.666m		
2+083.783m	2+113.026m	Line		29.244m		

Table 2: Proposed Horizontal Geometry of Southbound Diverge Slips Roads

Southbound Diverge Slip Road		70kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Start	End					
0+000.00m	0+184.57m	Line		184.57m		Taper Length
0+184.57m	0+265.38m	Line		80.81m		Nose Length
0+265.38m	0+301.09m	Line		35.71m		
0+301.09m	0+432.09m	Transition		131.00m		
0+432.09m	0+443.95m	Curve	720.00m	11.86m	360m	
0+443.95m	0+574.95m	Transition		131.00m		

Southbound Diverge Slip Road		70kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Srart	End					
0+574.95m	0+627.74m	Line		52.79m		

Table 3: Proposed Horizontal Geometry of Southbound Merge Slips Roads

Southbound Merge Slip Road		70kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Srart	End					
0+000.00m	0+113.42m	Line		28.967m		Taper Length
0+113.42m	0+133.42m	Transition		20.000m		Nose Length
0+133.42m	0+223.07m	Curve	37.500m	89.648m	360m	
0+223.07m	0+253.07m	Transition		30.000m		Start of 85kph design speed from chainage 251m
0+253.07m	0+259.00m	Line		5.929m		
0+259.00m	0+284.00m	Transition		25.000m		
0+284.00m	0+322.34m	Curve	510.00m	38.338m	360m	
0+322.34m	0+347.34m	Transition		25.000m		
0+347.34m	0+423.79m	Line		76.455m		
0+423.79m	0+448.99m	Line		25.198m		Existing Horizontal

Southbound Merge Slip Road		70kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Start	End					
						geometry retained through existing Yarnfield Lane Structure
0+448.99m	0+456.00m	Line		7.009m		
0+456.00m	0+467.59m	Line		11.592m		
0+467.59m	0+542.54m	Line		74.952m		Nose Length
0+542.54m	0+735.38m	Line		192.831m		Auxiliary Lane Length
0+735.38m	0+804.48m	Line		69.105m		Taper Length

Table 4: Proposed Horizontal Geometry of Northbound Diverge Slips Roads

Northbound Diverge Slip Road		70kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Start	End					
0+000.00m	0+075.00m	Line		75.00m		Taper Length
0+075.00m	0+275.00m	Line		200.00m		Auxiliary Lane Length
0+275.00m	0+283.08m	Line		8.99m		Existing Horizontal geometry retained through existing Yarnfield Lane Structure
0+283.08m	0+290.24m	Line		7.16m		
0+290.24m	0+299.58m	Line		9.33m		
0+299.58m	0+305.46m	Line		5.89m		
0+305.46m	0+396.47m	Curve	360.00m	91.00m	360m	
0+396.47m	0+480.31m	Line		90.30m		

Table 5: Proposed Horizontal Geometry of Northbound Merge Slips Roads

Northbound Merge Slip Road		70kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Start	End					
0+000.00m	0+062.59m	Line		62.59m		
0+062.59m	0+102.59m	Curve	158.62m	40.00m	360m	
0+102.59m	0+217.58m	Line		115.00m		Nose Length

Northbound Merge Slip Road		70kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Start	End					
0+217.58m	0+448.25m	Line		75.00m		Auxiliary Lane Length
0+448.25m	0+522.47m	Line		75.00m		Taper Length

Table 6: Proposed Horizontal Geometry of Emergency M6 Access

Emergency M6 Access		30kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Start	End					
0+000.00m	0+016.18m	Line		16.18m		
0+016.18m	0+040.03m	Curve	55.035m	23.85m	16m	
0+040.03m	0+119.57m	Line		79.53m		
0+119.57m	0+186.88m	Curve	40.250m	67.32m	16m	
0+186.88m	0+201.24m	Line		14.36m		

Table 7: Proposed Horizontal Geometry of Whitmore Farm Access

Whitmore Farm Access		30kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Start	End					
0+000.00m	0+112.42m	Line		112.42m		
0+112.42m	0+143.52m	Curve	20.00m	31.11m	16m	
0+143.52m	0+154.44	Line		10.92m		

Table 8: Proposed Horizontal Geometry of Pond Access

Pond Access		30kph Design Speed				
Chainage (m)		Horizontal Element	Radius (m)	Length (m)	DMRB Desirable Minimum Radius (m)	Comment
Start	End					
0+000.00m	0+26.63m	Line		26.63m		
0+26.63m	0+37.44m	Curve	90.00m	10.81m	16m	
0+37.44m	0+106.05m	Line		68.62m		
0+106.05m	0+118.20m	Curve	90.00m	12.14m	16m	
0+118.20m	0+343.13m	Line		224.93m		

4.4 Existing Vertical Profile

4.4.1 The existing vertical profile of Yarnfield Lane is detailed on the Plan and Profile drawings (nos. 2EW02-KIC-HW-DPP-WS05-000001 and 2EW02-KIC-HW-DPP-WS05-000002).

4.5 Proposed Vertical Profile

4.5.1 The proposed vertical profile of Yarnfield Lane is detailed on the Plan and Profile drawings (nos. 2EW02-KIC-HW-DPP-WS05-000001 and 2EW02-KIC-HW-DPP-WS05-000002).

4.5.2 The proposed vertical alignment of Yarnfield Lane has been designed on the basis of the following factors:

- Facilitate positive drainage of the carriageway;
- Proposed levels to be a continuation of existing where abutting the existing carriageway, to avoid any extensive reconstruction of the existing carriageway;
- Meet constraints/threshold to adjoining properties or boundaries;
- Avoid extensive works outside of tie-in points for the horizontal alignment.

4.5.3 The proposed vertical geometry for Yarnfield Lane is provided in the table below:

Table 9: Proposed Vertical Geometry of Yarnfield Lane

Yarnfield Lane Road		85kph Design Speed				
Chainage (m)		Vertical Element	K Value	Gradient Out %	Desirable Minimum K Value	Comment
Start	End					
0+029.87m	0+132.99m	Line	-	0.88%	-	
0+132.99m	0+156.99m	Sag	20		20	
0+156.99m	0+218.47m	Line	-	2.08%	-	
0+218.47m	0+299.94m	Sag	23.75	5.51%	20	
0+299.94m	0+640.15m	Crest	30	-5.83%	55	One step below des. min.

Yarnfield Lane – M6 Sliproads

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Yarnfield Lane Road		85kph Design Speed				
Chainage (m)		Vertical Element	K Value	Gradient Out %	Desirable Minimum K Value	Comment
Start	End					
0+640.15m	0+672.76m	Line	-	-5.83%	-	
0+672.76m	0+827.27m	Sag	22.80	0.95%	20	
0+827.27m	1+123.75m	Line	-	0.95%	-	
1+123.75m	1+187.53m	Sag	20	4.14%	20	
1+187.53m	1+203.38m	Line	-	4.14%	-	

4.6 Existing Cross Sectional Profile

- 4.6.1 The existing Yarnfield Lane carriageway is generally 6.0m wide and kerbed to adjoining landscape areas with crossfall provided to facilitate drainage via kerbside gullies.
- 4.6.2 A 45° splayed kerb is provided across the area of interest, except in a few notable locations, namely access to properties.

4.7 Proposed Cross Sectional Profile

- 4.7.1 The proposed Yarnfield Lane carriageway width will be 6.8m in accordance with HS2 Technical Standard – Roads, Appendix C – HS2 rural road design criteria, para. C.6.2.
- 4.7.2 The traffic frequencies shown in drawing 2PT02-ARP-PT-DSK-000-200207 within report 'The Proposed Scheme: Traffic and Transport Standard Exhibit Pack' (doc. ref. 861-ARP-PT-MAP-000-000442) show a high frequency of HGV traffic flows. Therefore in accordance with HS2 Technical Standard – Roads (doc. ref. HS2-HS2-HW-STD-000-000001) para. C.6.2 our design of the carriageway width of Yarnfield Lane is 6.8m as heavy goods vehicles are likely to pass each other on a regular basis.
- 4.7.3 A vehicle swept path analysis also highlighted the need to widen the Yarnfield Lane carriageway width throughout the proposed realignment to ensure safe passage of articulated HGV's travelling in opposite directions on the left and right-hand curves.
- 4.7.4 During engagement with Yarnfield and Cold Meece Parish Council, safety concerns were raised over the originally proposed carriageway width of 6.0m of Yarnfield Lane. These concerns were alleviated in a subsequent engagement meeting where the proposed width of 6.8m was communicated to the Parish Council. This is documented in section 25.1.3 of this report.
- 4.7.5 Earthworks have been provided at 1 (vertical) : 2.5 (horizontal).
- 4.7.6 The proposed alignment of the phase 2 (permanent) arrangement has been checked to ensure that the future provision of a D5ALR on the M6 is feasible. Figure 4 provides evidence of this feasibility, where a cross section has been generated at the location of the proposed overbridge (the pinch point).

4.8 Kerbs, Footways and Cycleways

- 4.8.1 Half batter and splay concrete kerbs designed to BS EN 1340 and HS2 standard details drawings HS2-CSI-HW-DDE-000-001102-FD to HS2-CSI-HW-DDE-000-001114-FD shall be provided at various sections throughout the scheme.
- 4.8.2 A proposed 3.0m wide shared footway/cycleway is proposed on the southbound side of Yarnfield Lane, this is the desirable minimum width in accordance with table 5-2 of LTN 1/20, and based on up to 300 pedestrians and 300 cyclists per hour (due to the rural nature of the site and having witnessed no cyclists or pedestrians during the WCHRA assessment, this is deemed to be a very reasonable assumption). Across Yarnfield Lane overbridge the 3.0m shared footway/cycleway width is maintained, this is more than the 2.0m absolute minimum width at constraints provided in LTN 1/20.
- 4.8.3 LTN 1/20 states there should be a minimum of 2m separation between the carriageway and shared footway/cycleway, however a departure from standard has been sought to reduce the separation to 0.5m. The bridge structure and HS2 infrastructure on either side of Yarnfield Lane constrain the available width, therefore 2.0m separation is not achievable over the length of Yarnfield Lane Overbridge itself. It is anticipated that any future extensions to the cyclepath at either end will want to minimise private land acquisition and a similar cross section will be used.
- 4.8.4 HS2 Technical Standard - Roads, C.6.21 states there shall be a minimum 0.5m grass verge between the 'edge of carriageway and path'. As designers we note that with Technical Standard – Roads the term 'path' refers to an unbound surface, however this is in the context of the shared use footway/cycleway which has a bound surface. Whilst respecting the minimum width we have taken the view that as a grass verge it could have the potential to create a muddy and slippery surface, particularly on the steeper gradients on approach to the bridge therefore with the safety of cyclists in mind have decided to hard pave the verge.
- 4.8.5 The grass verge proposed on the outside of the shared use facility is generally 1m wide either side of the overbridge. Allowance is made for stopping sight distance visibility splays, as a result the grass verge widens between approximate Ch,260 to 400 and Ch.910 to Ch.1090.

4.9 Constraints Assumptions

- 4.9.1 The main constraint is designing the works within the Limits of Deviation (LoD).
- 4.9.2 The avoidance of steep gradients poses constraints to the extent of the widening. This has been minimised by extending the existing crossfall of the carriageway into the widenings.

- 4.9.3 Vehicle tracking analysis has been undertaken and no issues have been identified.
- 4.9.4 All works have been undertaken with the highway boundary provided by Staffordshire County Council (SCC). This has been caveated by SCC that the highway boundaries they have provided may not be accurate.
- 4.9.5 The design is subject to schedule 4 approval by the County Council.

4.10 Junction Strategy

- 4.10.1 HS2 Technical Standard – Roads states in the C6.48 that 'For rural roads with a design speed greater than 60kph, major-minor junction layouts shall be designed in accordance with DMRB standard CD 123'.
- 4.10.2 The scheme will include the design of four new simple priority Junctions for the intersections between Yarnfield Lane with Whitemoor Farm access, Emergency northbound M6 Access, Emergency southbound M6/IMB-R Access and the pond access road respectively.
- 4.10.3 The required visibility splays for each junction are achieved in accordance with CD 123; 160m desirable minimum 'Y' distance along Yarnfield Lane and 2.4m 'X' distance set back along the minor road, with the exception of the Southbound emergency access connector road junction with Yarnfield Lane. The 'Y' distance looking right (south) at this junction is reduced to 110m due to the reduced crest curve K value over the M6 overbridge, a departure from standard was sought for this reduction in junction visibility (departure reference ECW2-DEP-S01-0002) and is detailed in risk assessment 2EW02-KIC-HW-RIA-A000-000002.

4.11 Existing Vehicle Restraint Systems

- 4.11.1 There are existing vehicle restraint systems (VRS) along the M6 in both directions.
- 4.11.2 As part of the proposed works the existing VRS will be removed and replaced to suit the new alignment, connecting into the existing VRS at either end.

4.12 Proposed Vehicle Restraint Systems

- 4.12.1 A preliminary Road Restraint Risk Assessment Process (RRRAP) was carried out in both directions along the Yarnfield Lane, the M6 Diverge and Merge Slip Roads from both the nearside and offside perspectives. This RRRAP has been further developed during scheme design.

4.12.2 From this assessment, the following hazards were identified:

- Earthwork embankments
- Yarnfield Lane overbridge structure;
- Above ground Infrastructure associated the All Lane Running on the M6 Motorway.
- Between the merge and diverge slip roads and the M6 motorway;
- Fillybrook watercourse (and associated headwalls of the culverts);

4.12.3 RRRAP sheets have not been included within Appendix A of this report due to online issues with the National Highways Road Restraint Risk Assessment Process and its outputs. The current Road Restraint design has been developed from earlier RRRAP's undertaken online.

4.12.4 For final scheme design a full and comprehensive RRRAP will be undertaken.

4.12.5 As part of detailed design, the two HS2 underbridges (east of the M6) will be included as part of the updated RRRAP assessment.

4.13 Existing Pedestrian Restraint Systems

4.13.1 Not applicable.

4.14 Proposed Pedestrian Restraint Systems

4.14.1 Not applicable.

5 Boundary Treatments

5.1 Existing Assets

- 5.1.1 Existing fence lines, gates and hedging is to be removed from site that cross the proposed route.

5.2 Proposed Assets

- 5.2.1 The existing fence road is to be relocated on to the LOD boundary line. The existing hedgerow shall be relocated such that it does not interrupt the junction visibility splays.
- 5.2.2 The proposed fencing that is to be installed adjacent to private land is currently specified as timber post and rail fencing. This is likely to be updated in the detailed design, where the respective landowners will be consulted with and the type of fencing shall be agreed with them.
- 5.2.3 The type of proposed fence line adjacent to Staffordshire County Council land shall be in accordance with the Staffordshire County Council standard details and to be tied into existing fence lines where present.
- 5.2.4 The highway boundary will be the hedgerow where present.
- 5.2.5 The highway boundary will be on the road side of the proposed fencing where no hedgerow is present.
- 5.2.6 The boundary treatment adjacent to the IMB-R is currently proposed as timber post and rail. The interface between the proposed slip roads and IMB-R will be developed during detailed design in conjunction with the drainage and earthworks design and as a result the timber fencing is considered to be temporary, likely to be replaced with a security fence once the IMB-R platform is established.

6 Traffic Assessment

- 6.1.1 Traffic analysis has been undertaken and the results are included within Volume 5 of the Environmental Statement and no further traffic assessments are proposed within this scheme.
- 6.1.2 The traffic data is summarised in the Preliminary Design Element Statement: 221-S1 Yarnfield Lane Underbridges and Overbridge (C861-ARP-BR-DES-WS04-000007 P04).

7 Pavement Design

7.1 National Highway (NH) Roads

Design Traffic Assessment

- 7.1.1 It was assumed that the HS2 construction traffic would traffic the Scheme for a 5-year period.
- 7.1.2 The Design Traffic design was based on the traffic figures provided for Site A, Site B, Site C and Site D in the report titled 'C861-ARP-PT-MAP-000-000442 Stone/IMB-R'. For the M6 Slip Lanes it was assumed that all construction traffic would be OGV2, there would be no growth in construction traffic and that there would be a design life of 5 years.
- 7.1.3 The 2023 future baseline AADF figure for the M6 southbound Slip-off and the northbound Slip-on lanes is 800. The design traffic figure was calculated to be 7.2msa.
- 7.1.4 The 2023 future baseline AADF figure for the M6 southbound slip-on and the northbound slip-off lanes is 409. The design traffic figure was calculated to be 3.7msa.

Foundation Design

- 7.1.5 A restricted foundation stiffness class 2 design is proposed, in accordance with CD 225. The designer proposes 3 No. foundation design to allow the appropriate foundation type to be selected at construction for each section based on the in-situ subgrade surface modulus.

Table 10: Class 2 Restricted Foundation of Design Subgrade Surface Modulus of 30MPa (NH)

Design subgrade surface modulus – 30MPa		
Pavement Layer	Material	Thickness (mm)
Subbase	Cl.803	250
Capping	Cl.613	430
Total Thickness (mm)		680

Table 11: Class 2 Restricted Foundation of Design Subgrade Surface Modulus of 50MPa (NH)

Design subgrade surface modulus – 50MPa		
Pavement Layer	Material	Thickness (mm)
Subbase	Cl.803	200
Capping	Cl.613	250
Total Thickness (mm)		450

Table 12: Class 2 Restricted Foundation of Design Subgrade Surface Modulus of 100MPa (NH)

Design subgrade surface modulus – 100MPa		
Pavement Layer	Material	Thickness (mm)
Subbase	Cl.803	200
Total Thickness (mm)		200

Pavement Design

- 7.1.6 The pavement design is completed in accordance with CD226.
- 7.1.7 The design traffic figure for the M6 Southbound Slip-off, the Northbound Slip-on and the junction Roundabout was calculated to be 7.2msa. In accordance with CD226 Figure 2.20 and the DMRB requirements, the pavement design is detailed as Pavement Type – FF1.
- 7.1.8 For areas where the width of pavement construction is less than 0.9m, ST4 concrete can be used as a replacement for the bituminous base course material to ensure adequate compaction of the base course material. This is detailed as Pavement Type – FF1A.

Table 13: Pavement Design for M6 Southbound Diverge, Northbound Merge and Junction Roundabout (NH)

Pavement Type – FF1		
Pavement Layer	Material Reference	Thickness (mm)
Surface Course	SMA 14 surf	50
Binder Course	AC 20 dense bin 40/60	60
Base	AC 32 dense base 40/60	150
Total Thickness (mm)		260

Table 14: Pavement Design for M6 Southbound Diverge, Northbound Merge and Junction Roundabout (NH)

Pavement Type – FF1A		
Pavement Layer	Material Reference	Thickness (mm)
Surface Course	SMA 14 surf	50
Binder Course	AC 20 dense bin 40/60	60
Base	ST4 Concrete	150
Total Thickness (mm)		260

- 7.1.9 The design traffic figure for the M6 Southbound Slip-on and the Northbound Slip-off lanes was calculated to be 3.7msa. In accordance with CD226 Figure 2.20 and the DMRB requirements, the pavement design is detailed as Pavement Type – FF2.
- 7.1.10 For areas where the width of pavement construction is less than 0.9m, ST4 concrete can be used as a replacement for the bituminous base course material to ensure adequate compaction of the base course material. This is detailed as Pavement Type – FF2A.

Table 15: Pavement Design for M6 Southbound Merge and Northbound Diverge (NH)

Pavement Type – FF2		
Pavement Layer	Material Reference	Thickness (mm)
Surface Course	SMA 14 surf	50
Binder Course	AC 20 dense bin 40/60	60
Base	AC 32 dense base 40/60	125
Total Thickness (mm)		235

Table 16: Pavement Design for M6 Southbound Merge and Northbound Diverge (NH)

Pavement Type – FF2A		
Pavement Layer	Material Reference	Thickness (mm)
Surface Course	SMA 14 surf	50
Binder Course	AC 20 dense bin 40/60	60
Base	ST4 Concrete	125
Total Thickness (mm)		235

- 7.1.11 The surface course material skid resistance properties shall comply with the requirements of CS 228 and CD 236. Limestone aggregates shall not be used in the surface course material in accordance with CD 236 Clause 3.14.
- 7.1.12 CD 236 Clause 3.15 states that the PSV (Polished Stone Value) and AAV (Aggregate Abrasion Value) shall be based on the commercial vehicles per lane per day (cv/lane/day) at the end of the anticipated design life of the surface course. The Designer has assumed a design life of 10 years for the surface course, in line with common industry practice. The cv/lane/per at the end of the 10-year design life period was calculated based on the figures provided in the traffic report detailed in Section 3.1 of this Report and in accordance with CD 224 Equation 2.14.
- 7.1.13 The site classification for each section is as per CD 236 Table 3.3b and CS 228 Figure A.1. The Investigatory Level (IL) designation is in accordance with CS 228 Table 4.2.

Table 17: PSV and AAV Requirements (NH)

Road Name	Commercial Vehicles (cv/lane/day)	Site Category	IL	Min PSV	Max AAV
M6 southbound merge (slip-on)	409	B	0.35	50	16
M6 northbound diverge (slip-off)	409	B	0.35	50	16
M6 northbound diverge (slip-off), 50m approach to roundabout	409	Q	0.45	65	16
M6 northbound merge (slip-on)	800	B	0.35	50	16
M6 southbound diverge (slip-off)	800	B	0.35	50	16
M6 southbound diverge (slip-off), 50m approach to roundabout	800	Q	0.45	68+	16
Roundabout	800	R	0.45	60	16

7.2 Staffordshire County Council (SCC) Roads

Design Traffic Assessment

- 7.2.1 The Design Traffic design was based on the traffic figures provided for Site K and Site L in the report titled 'C861-ARP-PT-MAP-000-000442 Stone/IMB-R'.
- 7.2.2 The 2023 future baseline AADF figure for the eastbound lane was 2,047 and for the westbound lane was 2,285. The 2023 future baseline plus HS2 AADF figure for the eastbound lane was 2,334 and for the westbound lane was 2,582.
- 7.2.3 The designer assumed the HS2 construction traffic would use the road from Year 0 to Year 5, therefore the 2023 future baseline plus HS2 traffic was used for this time period. After Year 5, the traffic reverted back to the Year 5 figure for the 2023 future baseline AADF traffic figures.
- 7.2.4 A Design Traffic figure was calculated in accordance with CD 224, for a design life of 40 years.
- 7.2.5 Table 18 shows the wear factors and the growth factors used for each CV class in the calculation. The wear factors (W_N) used were obtained from CD 224 Table 2.18. Wear factors designated for new road schemes were utilised as the proposed scheme includes widening works and the construction of a full pavement. Equivalent annual growth rates (R) used were derived from Table 2.12 Note 2, as the calculation was completed for each year.
- 7.2.6 A design traffic of 7.1 million standard axles (msa) was calculated, as per CD 224 Equation 2.23b.

Table 18: Wear Factor and Growth Factors for Vehicle Classes and Categories

Vehicle Class	Wear Factor (W _N)	Annual Growth Rate (R)
PSV (Buses and coaches)	3.9	1.07%
2-axle rigid	0.6	1.07%
3-axle rigid	3.4	1.07%
4-axle-rigid	4.6	2.10%
3 to 4-axle artic	2.5	2.10%
5-axle artic	4.4	2.10%

Foundation Design

7.2.7 A restricted foundation stiffness class 2 design is proposed, in accordance with CD 225. The designer proposes 3 No. foundation design to allow the appropriate foundation type to be selected at construction for each section based on the in-situ subgrade surface modulus.

Table 19: Class 2 Restricted Foundation of Design Subgrade Surface Modulus of 30MPa (SCC)

Design Subgrade Surface Modulus – 35MPa		
Pavement Layer	Material	Thickness (mm)
Subbase	Cl.803	230
Capping	Cl.613	380
Total Thickness (mm)		610

Table 20: Class 2 Restricted Foundation of Design Subgrade Surface Modulus of 50MPa (SCC)

Design Subgrade Surface Modulus – 50MPa		
Pavement Layer	Material	Thickness (mm)
Subbase	Cl.803	200
Capping	Cl.613	250
Total Thickness (mm)		450

Table 21: Class 2 Restricted Foundation of Design Subgrade Surface Modulus of 100MPa (SCC)

Design Subgrade Surface Modulus – 100MPa		
Pavement Layer	Material	Thickness (mm)
Subbase	Cl.803	200
Total Thickness (mm)		200

Pavement Design

- 7.2.8 The pavement design is completed in accordance with CD226.
- 7.2.9 The design traffic figure for the Yarnfield Lane was calculated to be 7.1msa. The pavement design is based in accordance with CD226 Figure 2.20, the SCC requirements and SCC allowable material types. This is detailed as Pavement Type – FF3.
- 7.2.10 For areas where the width of pavement construction is less than 0.9m, ST4 concrete can be used as a replacement for the bituminous base course material to ensure adequate compaction of the base course material. This is in accordance with SCC drawing no. 07.09 (Highway Works Detail Series 700 – Carriageway Widening). On this basis, ST4 Concrete is proposed as the base course material based on the proposed widths of the pavement construction. This is detailed as Pavement Type – FF3A.

Table 22: Pavement Design for Yarnfield Lane (SCC)

Pavement Type – FF3		
Pavement Layer	Material Reference	Thickness (mm)
Surface Course	HRA 35/14 F surf 40/60 des	50
Binder Course	AC 20 dense bin 100/150 rec	60
Base	AC 32 dense base 100/150 rec	150
Total Thickness (mm)		260

Table 23: Pavement Design for Yarnfield Lane (SCC)

Pavement Type – FF3A		
Pavement Layer	Material Reference	Thickness (mm)
Surface Course	HRA 35/14 F surf 40/60 des	50
Binder Course	AC 20 dense bin 100/150 rec	60
Base	ST4 Concrete	150
Total Thickness (mm)		260

- 7.2.11 The scheme includes a bridge deck on Yarnfield Lane. The pavement design for the bridge deck is in accordance with CD358, the SCC requirements and SCC allowable material types. The thickness of the binder course was selected to ensure ease of construction. The bridge deck pavement type does not require a foundation. The bridge deck pavement type is detailed as Pavement Type – BD1.

Table 24: Pavement Design for Bridge Deck (SCC)

Pavement Type – BD1		
Pavement Layer	Material Reference	Thickness (mm)
Surface Course	HRA 35/14 F surf 40/60 des	50
Binder Course	AC 20 dense bin 100/150 rec	60
Base	HRA 0/2 F surf 40/60	20
Total Thickness (mm)		130

- 7.2.12 The surface course material skid resistance properties shall comply with the requirements of 'Staffordshire County Council – Economy, Infrastructure and Skills – Skid Resistance Policy (April 2020)' (SCC Skid Resistance Policy), CS 228 and CD 236. Limestone aggregates shall not be used in the surface course material in accordance with CD 236 Clause 3.14.
- 7.2.13 CD 236 Clause 3.15 states that the PSV (Polished Stone Value) and AAV (Aggregate Abrasion Value) shall be based on the commercial vehicles per lane per day (cv/lane/day) at the end of the anticipated design life of the surface course. The Designer has assumed a design life of 10 years for the surface course, in line with common industry practice. The cv/lane/per at the end of the 10-year design life period was calculated based on the figures provided in the traffic report detailed in Section 3.1 of this Report and in accordance with CD 224 Equation 2.14.
- 7.2.14 The site classification for each section is as per CD 236 Table 3.3a. The Investigatory Level (IL) designation is in accordance with CS 228 Table 4.2.

Table 25: PSV and AAV Requirements (SCC)

Road Name	Commercial Vehicles (cv/lane/day)	Site Category	IL	Min PSV	Max AAV
Yarnfield Lane	200	C	0.40	55	14
Yarnfield Lane, 50m approach to junctions	200	Q	0.45	60	14

7.3 HS2 Roads

Design Traffic Assessment

- 7.3.1 It was assumed that the HS2 construction traffic would traffic the Scheme for a 5-year period.
- 7.3.2 The HS2 Roads for the Scheme consist of 2 No. Access Tracks. No traffic figures were provided for the Access Tracks. It was assumed that Access Track No. 1 would have a design life of less than 5msa and it was assumed Access Track No. 2 would have a design life of less than 1msa.

Pavement Design

- 7.3.3 The pavement design for the HS2 access tracks is in accordance with the HS2 drawing reference 'HS2-CSI-HW-DDE-000-000724-FD' and 'HS2-CSI-HW-DDE-000-000725-FD'.
- 7.3.4 The design traffic figure for Access Track No. 1 was assumed to be less than 5msa, the design provided is in accordance with HS2 drawing reference 'HS2-CSI-HW-DDE-000-000724-FD Access Track Type 1 Reinforced Concrete'. The design is based on a design CBR value of 5%. This is detailed as Pavement Type – Access Track 1.

Table 26: Pavement Design for HS2 Access Track 1 (HS2)

Pavement Type – Access Track 1 (Pond Access Track)		
Pavement Layer	Material Reference	Thickness (mm)
Surface Course	C32/40 Reinforced Concrete	150
Geomembrane	Clause 1007	-
Subbase	Clause 822 (C8/10)	225
Total Thickness (mm)		375

- 7.3.5 The design traffic figure for Access Track No. 2 was assumed to be less than 1msa, the design provided is in accordance with HS2 drawing reference 'HS2-CSI-HW-DDE-000-000725-FD Access Track Type 2 Reinforced Concrete'. The design is based on a design CBR value of 5%. This is detailed as Pavement Type – Access Track 2.

Table 27: Pavement Design for HS2 Access Track 2 (HS2)

Pavement Type – Access Track 2 (Whitemoor Farm and Field Access)		
Pavement Layer	Material Reference	Thickness (mm)
Surface Course	SMA 14 surf	35
Binder Course	AC 20 dense bin 40/60	165
Subbase	Cl.803	340
Total Thickness (mm)		540

7.3.6 The surface course material skid resistance properties shall comply with the requirements of CS 228 and CD 236. Limestone aggregates shall not be used in the surface course material in accordance with CD 236 Clause 3.14.

7.3.7 CD 236 Clause 3.15 states that the PSV (Polished Stone Value) and AAV (Aggregate Abrasion Value) shall be based on the commercial vehicles per lane per day (cv/lane/day) at the end of the anticipated design life of the surface course. The Designer has assumed a design life of 10 years for the surface course, in line with common industry practice. The cv/lane/per at the end of the 10-year design life period was calculated based on the figures provided in the traffic report detailed in Section 3.1 of this Report and in accordance with CD 224 Equation 2.14.

7.3.8 The site classification for each section is as per CD 236 Table 3.3a and Table 3.3b. The Investigatory Level (IL) designation is in accordance with CS 228 Table 4.2.

Table 28: PSV and AAV Requirements (HS2)

Road Name	Commercial Vehicles (cv/lane/day)	Site Category	IL	Min PSV	Max AAV
Access Track No.1	200	C	0.40	55	16
Access Track No.1, 50m approach to junction	200	Q	0.45	60	16
Access Track No.2	200	C	0.40	50	16
Access Track No.2	200	Q	0.45	60	16

8 Traffic Signs and Road Markings

8.1 Existing Traffic Signs

- 8.1.1 All existing signs along the proposed route shall be uplifted and removed from site. They shall be stored during the works and assessed for suitability for reuse.

8.2 Proposed Traffic Signs

- 8.2.1 All proposed new advanced direction signs, direction signs, regulatory and warning signs shall be designed in accordance with:

- The Traffic Signs Regulations and General Directions 2016 (TSRGD);
- The Traffic Signs Manual;
- The DMRB; and
- Local Transport Note 1/94.

- 8.2.2 Existing bespoke signs will be replaced.

- 8.2.3 Traffic sign poles which do not have appropriate RRS protection shall be designed to be passively safe (in accordance with BS -EN 12767).

8.3 Existing Road Markings

- 8.3.1 Existing road markings and road studs are in line with a standard 4 lane managed motorway and are in an acceptable condition. A solid white edge line delineates the existing works access to Yarnfield Lane which is accessed by a lane gain.

- 8.3.2 Yarnfield Lane has a centreline marking (TSRGD diagram 1004.1) throughout. There are no edge lines on Yarnfield Lane within the extent of works other than double yellow lines on the approaches to the existing M6 overbridge.

8.4 Proposed Road Markings

- 8.4.1 Existing road markings on the M6 both northbound and southbound shall be retained, with the exception of the nearside edge line which will be removed and replaced with appropriate markings at the newly formed slip roads.

- 8.4.2 All new road markings and road studs on the M6 slip roads, as well as the realigned Yarnfield Lane and associated junctions will be designed in accordance with TSRGD and Chapter 5 of traffic signs manual.

9 Street Lighting

9.1 Existing Street Lighting

9.1.1 There is no existing street lighting associated with Site 1 or Site 1a.

9.2 Proposed Street Lighting

9.2.1 No new street lighting has been proposed.

10 Technology

10.1 Existing Technology

10.1.1 There is All Lane Running technology infrastructure, NRTS (National Roads Telecommunications Service) (SMART motorways infrastructure) that is owned by National Highways on the both the northbound and southbound carriageways of the M6 motorway.

10.1.2 This infrastructure, that the proposed alignment will clash with is comprised of:

- Three Variable Message Signs (VMS');
- A SVD unit;
- A CCTV camera;
- A MIDAS unit;
- Cabinets;
- Associated ducting & cabling; and
- Two temporary CCTV cameras

10.2 Proposed Technology

10.2.1 The design of like for like replacement of all the infrastructure listed in Section 10.1.2 will be provided, with the exception of the temporary CCTV cameras which will not be replaced.

10.2.2 The proposed moving of infrastructure equipment associated with All Lane Running will be subject to checks during detailed design against design standards for visibility and the like to ensure compatibility.

10.2.3 The construction sequencing of the equipment shall be so that the existing equipment shall not be removed prior to the replacement equipment being fully operational. This is to ensure the safety of all M6 road users.

11 Other Street Furniture

- 11.1.1 Refer to the Site Clearance drawings for the other street furniture that shall be removed.
- 11.1.2 No additional or replacement other street furniture has been included in the design.

12 Drainage

12.1 Design Status

- 12.1.1 The design of the M6 drainage networks are based on the information received on the existing network (the as-built survey information and HADDMS information).
- 12.1.2 The drainage surveys for Site 1A are yet to be completed and there is little information on the existing networks. Due to a lack of available information the current design of Site 1A only includes the indicative location of Gullies. The drainage design of Site 1A (the drawings and content of this report) will be updated following the receipt of this information which is currently programmed for delivery next stage (detailed design).

12.2 Existing Drainage Assets

Existing Drainage

- 12.2.1 The existing drainage is a combination of over the edge drainage combined with gully collection systems along the Yarnfield Lane. The ditches outfall into the existing drain and then through the existing culvert on Yarnfield Lane on the northern side of the overbridge and on the southern side of the overbridge. The ditches outfall into the Filly Brook and then through the culvert under the existing M6. The existing M6 network consists of surface water channels, slot drains as a collection system with carrier drains, filter drains and ditches. The pipes are oversized to attenuate flow and there are flow control devices to restrict the flow. There are multiple existing outfalls from the M6 network into Filly Brook.

12.3 Proposed Drainage Assets

Nature of Catchment

- 12.3.1 The catchments comprise the carriageway and verges (including footpath) of the proposed road network, together with the associated earthworks, and over land flow.
- 12.3.2 There are five catchments' areas within the Site 1 and are shown in Figure 7 below.

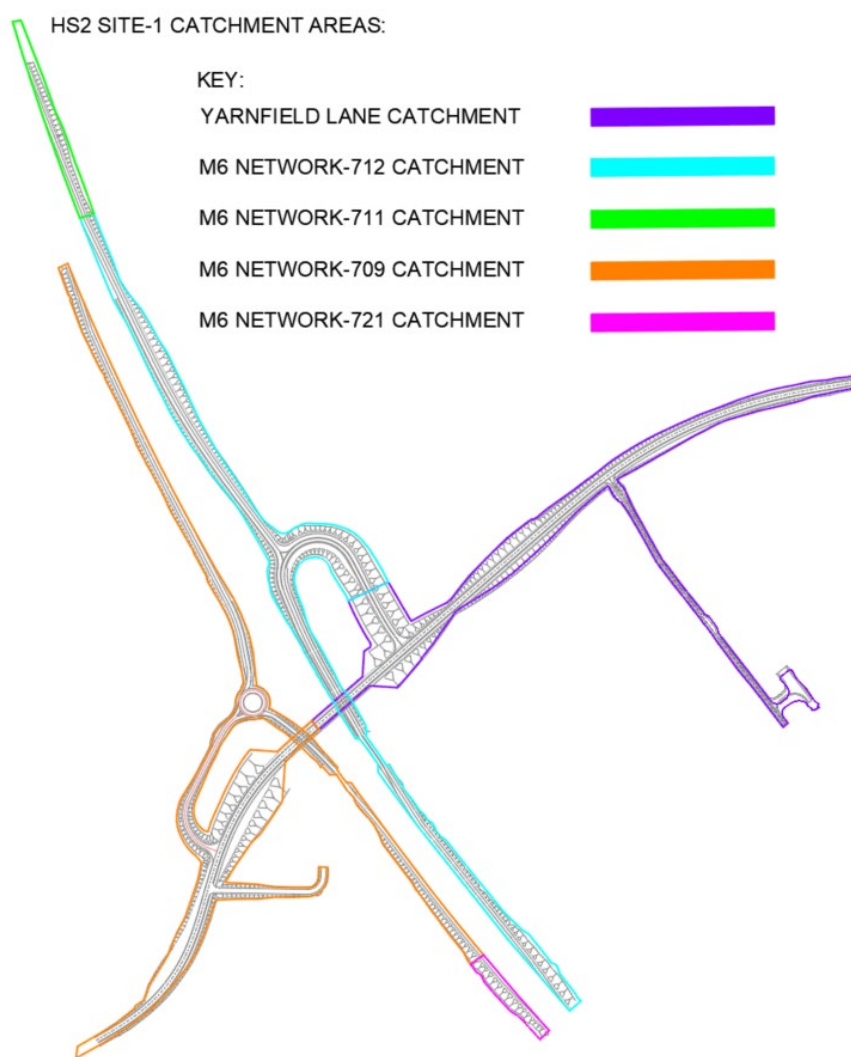


Figure 7: Catchment Areas for Site 1

12.3.3 There is one catchment area within Site 1A and is shown in Figure 8 below.

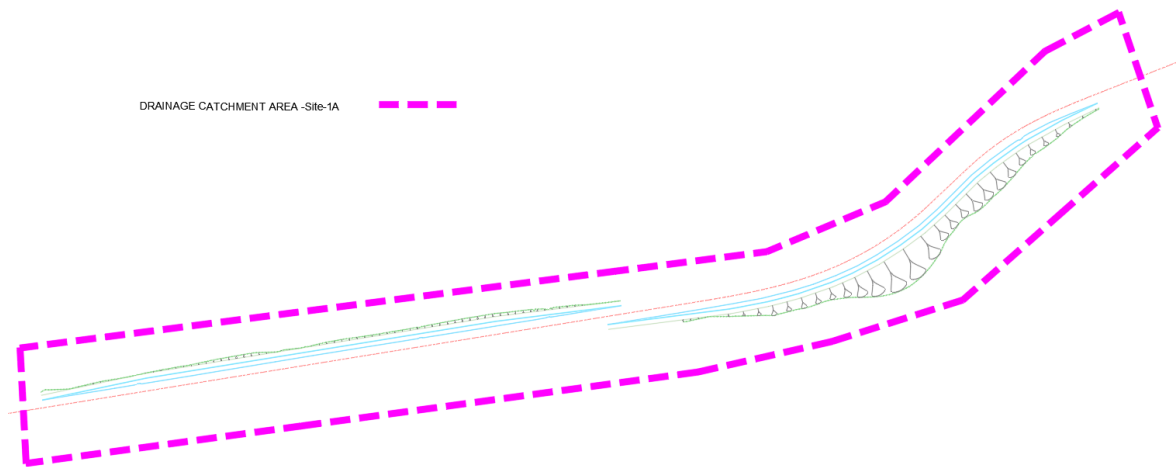


Figure 8: Catchment Area for Site 1A

12.3.4 The catchments are delineated based on the high and low points. The Yarnfield Lane bridge act as the high point on the north and south Yarnfield Lane catchments. These catchments also include some of the M6 networks. The M6 catchments are consistent with the existing design catchments but include the proposed additional areas to the road network associated with the slip roads.

12.3.5 The Yarnfield Lane catchment to the north of the bridge consists of the northern portion of the Yarnfield Lane. It has an attenuation pond, and the collection system is comprised of gullies and the conveyance system is comprised of carrier drains and ditches.

12.3.6 The M6 network-711 catchment consists of the northbound M6, slip roads and southern portion of Yarnfield Lane. The existing M6 network has been retained wherever possible but at the extra lane locations the system will be relocated to edge of pavement and into the proposed verge. The existing collection system on the M6 comprises of a surface water channel and slot drains and the proposed uses the same arrangement. The proposed conveyance system is comprised of carrier drains and ditches, which again mirrors the existing arrangement. The existing online storage system will be replaced but the same arrangement will be provided. This system includes the Filly Brook diversion, the extension of existing culvert underneath the M6, the extension of the existing culvert of the Filly Brook underneath the proposed and existing Yarnfield Lane and the proposed culvert underneath the roundabout.

12.3.7 The M6 network-712 catchment consists of the southbound M6 and slip roads. The existing collection system on the M6 comprises of a surface water channel and slot

drains and the proposed uses the same arrangement. The proposed conveyance system is comprised of carrier drains and ditches, which again mirrors the existing arrangement. The existing online storage system will be replaced but the same arrangement will be provided.

- 12.3.8 The M6 network-709 catchment consists of the southern section of the northbound M6 (to the east of Filly Brook culvert that flows underneath the M6). The existing M6 network has been retained wherever possible but the ditches and filter drains at toe of the proposed embankment has been relocated as the earthworks design requires.
- 12.3.9 The M6 network-721 catchment consists of the northern section of the southbound M6. The existing M6 network has been retained wherever possible but the ditches and filter drains at toe of the proposed embankment has been relocated as the earthworks design requires.
- 12.3.10 The site 1A area consist of the existing carriage way and proposed lane extension and earthwork embankment.

Time of Entry

- 12.3.11 The minimum global time of entry is 5 minutes.

Rainfall Intensity

- 12.3.12 The design rainfall intensity is 50 mm for the pipe network.

Roughness Coefficient

- Carrier Pipes: 0.6 mm
- Filter Drains: 1.5 mm
- Ditch: $n = 0.030$

Permeability of Areas

- 12.3.13 The area contributing to each drainage network is obtained by multiplying the actual measured area by the following factors:
- Paved surfaces and impermeable areas: 0.90
 - Verges where these are not paved: 0.25
 - Cut/Embankments: 0.55
 - Overland flow from farmland: 0.10

Pipe Flow Velocities

- 12.3.14 The minimum pipe flow velocity will be 0.75 m/sec during the 1-year return storm. The maximum pipe flow velocity at discharge points will be 2.5 m/sec.

Cover to Drains

- 12.3.15 The preferred minimum cover to carrier drains, measured from finished ground level to the pipe soffit, will be 1.2 m. Where the cover to carrier pipes is less than this they will be surrounded in concrete. All road crossings to be surrounded in concrete regardless of cover depth. The minimum cover to filter drains will be the depth of road construction, including capping, plus 50mm (i.e. the soffit of the filter drain pipe will be at least 50mm below the bottom of the capping layer).

Drain Sizes and Lengths

- 12.3.16 The minimum carrier drain, or filter drain size will be 150 mm. The minimum pipe diameter for gully and linear drainage channels connections shall be 150 mm. The maximum distance between accesses on length of pipe shall be 100 metres.

Gully Spacings

- 12.3.17 The spacing of gullies will be based on the principles set out in CD 526 – “Spacing of Road Gullies”. Double gullies shall be provided at sag points.

Design Flow Widths

- Yarnfield Lane: 0.5m (to be agreed with SCC)
- Roundabout: 1.0m (to be agreed with HS2)

Attenuation Pond

- 12.3.18 The attenuation storage has been calculated by modelling the proposed drainage networks in MicroDrainage. The outfalls have been modelled under downstream surcharged conditions to allow sufficient attenuation storage, with surcharge levels taken from the hydraulic modelling undertaken for the Environmental Impact Assessment. The attenuation pond is located to the northeast Yarnfield Lane. Online storage in swales is proposed and the pipes are oversized on the southside of Yarnfield Lane. Attenuation storage has been designed in accordance with the following standard:

- HS2-HS2-DR-STD-000-000002 SECTION 4.2.18-22 & 4.4.10 -12

Assumptions

12.3.19 The following assumptions have been made:

- The system has been designed under pipe full conditions to accept the 1-year storm without surcharging above pipe soffit and no flooding of the running carriageway is permitted during a 1 in 5-year event.
- There is a 40% increase/allowance in the flow, to account for the impact of climate change, when calculating the drainage network requirements for all newly proposed areas. For the existing network, the drainage design includes the same climate change allowance as the original design proposed (which is understood to be a 20% increase/allowance).
- The existing drainage infrastructure detected is of suitable condition for integration into the design and can be tied into where appropriate.
- Discharge rates for Yarnfield Lane and the M6 match the existing rates, which is in accordance with HS2-HS2-DR-STD-000-000002 SECTION 5.
- Sources of existing drainage network data are from M6 models, HADDMS data and the topographic survey. It is assumed that these sources have provided accurate information.
- The Site 1A existing drainage survey information is required to complete design. Due to the lack of available existing information for this area, only an indicative design is currently able to be completed.
- The bridge deck drainage system will be designed in the detailed design stage but the surface runoff associated with the bridge has been included in the respective networks.

Flood Risk Assessment

12.3.20 The baseline of the flood model has been completed but the integration of the proposed design is currently being integrated into the flood model.

12.3.21 The flood modelling and associated reporting, once complete, will inform the flood risk mitigation elements of the design. These elements will be incorporated into the design at the detailed design stage.

13 Structures

- 13.1.1 The Yarnfield Lane M6 overbridge replacement structure is not covered in this HDR, please refer to AIP Report 2EW02-KIC-ST-REP-WS05-000001 for details of the structure.
- 13.1.2 The required headroom to the future HS2 underbridges has been allowed for, the designer of these bridges will need to take this into consideration.
- 13.1.3 There is one additional proposed piped culvert and two proposed piped culvert extensions included in the design of the diversion of the Filly Brook Watercourse.
- 13.1.4 There is an additional proposed piped culvert and two proposed piped culvert extensions included in the design of minor drains on Yarnfield Lane (northeast of the M6).
- 13.1.5 There are two VMS structures that are to be replaced on the northbound merging slip of the M6.

14 Departures from Standards

14.1 Existing Departures from Standard

14.1.1 Four existing departures from standard have been identified for Site 1a. These departures are as follows:

Table 29: Existing Departures from Standards

Departure No.	Relevant Standard(s)	Clause(s)	Location	Difference between standard(s) and proposed design	Associated departures / relaxations
EX-001	CD 109	2.9 & Table 2.10	Phase 2: Yarnfield Lane	Horizontal curve of 105m - Five steps below desirable minimum radius at 85kph design speed from Ch. 1+976.89m to 2+015.30m	EX-003
EX-002	CD 109	2.9 & Table 2.10	Phase 2: Yarnfield Lane	Horizontal curve of 94.5m - Five steps below desirable minimum radius at 85kph design speed from Ch. 2+033.00m to 2+054.12m	EX-004
EX-003	CD 109	2.9 & Table 2.10	Phase 2: Yarnfield Lane	Stopping Sight Distance of 42.6m Northbound – Five steps below desirable minimum from Ch.1+823.63m to 1+993.63m.	EX-001
EX-004	CD 109	2.9 & Table 2.10	Phase 2: Yarnfield Lane	Stopping Sight Distance of 47.33m Southbound – Five steps below desirable minimum from Ch.2+113.03m to 1+953.03m.	EX-002

14.1.2 Existing departures EX-001 and EX002 are unaffected by the proposed works to Site 1A. There is a marginal improvement to the north and southbound SSD in existing departures EX-003 and EX-004 however they both remain 5-steps below desirable minimum.

14.2 Proposed Departures from Standards

14.2.1 Twenty-five departures from standards associated with Site 1 and none for Site 1a design have been identified during scheme design. These are detailed within the Departures Register (2EW02-KIC-DS-REG-000017).

14.3 Proposed Relaxations from Standards

- 14.3.1 Six relaxations from standards associated with Site 1 and none for Site 1a have been identified during scheme design. These are listed in Appendix B.

15 CDM Compliance and Key Hazards and Risks

15.1 CDM Compliance

15.1.1 CDM compliance will be achieved through a number of recorded meetings:

- Buildability reviews;
- IDCs; and
- IDRs.

15.1.2 The CDM Risk Register (2EW02-KIC-DS-REG-WS05-000025) captures and eliminates or mitigates the risks associated with the design that may arise throughout the whole life of the scheme.

15.2 Potential Construction Hazards

15.2.1 Design related construction hazards and their mitigations have been included in the CDM Risk Register (2EW02-KIC-DS-REG-WS05-000025) and in all design drawings (within the SHE boxes).

15.3 Potential Maintenance and Future Demolition Hazards

15.3.1 Design related maintenance and future demolition hazards and their mitigations have been included in the CDM Risk Register (2EW02-KIC-DS-REG-WS05-000025) and in all design drawings.

15.3.2 Design related operational hazards and their mitigations have been included in the CDM Risk Register (2EW02-KIC-DS-REG-WS05-000025).

15.4 Potential Hazards or Risks Considered During the Design

15.4.1 CDM Risk Register (2EW02-KIC-DS-REG-WS05-000025) considers all the risks associated with the design that may arise throughout the life cycle of the scheme at the design stage.

16 Road Safety Audits

16.1 Road Safety Audit stage 1

16.1.1 The Stage 1 Road Safety Audit been undertaken and provisional responses have been provided in the Road Safety Audit Stage 1 Designers Report (2EW02-KIC-HW-REP-WS05-000002).

16.1.2 These latest Road Safety Audit Decision Log, taken from the work-in-progress above report, is included in Table 30 below.

Table 30: Road Safety Audit Decision Log

No.	RSA Problem	RSA Recommendation	Design Organisation Response
3.1	Risk of junction collisions could lead to motorists being injured. The scheme proposes to provide a new farm access on Yarnfield Lane at chainage 250m. Visibility from the new access to the right could be restricted should a vehicle restraint system, bridge parapet, fence or other street furniture be placed within the visibility splay. Any restriction to visibility will increase the risk of collisions between turning vehicles and oncoming traffic and could lead to motorists being injured.	It is recommended that sufficient visibility for predicted traffic flows and 85th percentile speeds on Yarnfield Lane is provided from the farm access.	Accept Full junction visibility is achieved, and is measured in accordance with CD 123 where the X distance is 2.4m on the minor road and the Y distance along the major road is 160m (des. min SSD for 85kph design speed Yarnfield Lane) in both directions.
3.2	Risk of junction collisions could lead to motorists being injured. The scheme proposes to provide a new junction from the M6 southbound access on Yarnfield Lane at chainage 600m. Visibility from the new	It is recommended that sufficient visibility for predicted traffic flows and 85th percentile speeds on Yarnfield Lane is	Accept Junction visibility to the left is achieved, and is measured in accordance with CD 123 where the X distance is 2.4m on the minor road and the Y distance along the major road is 160m (des. min SSD

No.	RSA Problem	RSA Recommendation	Design Organisation Response
	junction to the right could be restricted should a vehicle restraint system, bridge parapet, fence or other street furniture be placed within the visibility splay. Any restriction to visibility will increase the risk of collisions between turning vehicles and oncoming traffic and could lead to motorists being injured.	provided from the junction.	for 85kph design speed (Yarnfield Lane) in both directions. A departure from standard is proposed for reduced visibility to the right due to the crest of the M6 overbridge. Mitigation measures will be provided with advance warning signs to motorists on Yarnfield lane included to advise of junction ahead.
3.3	Risk of pedestrians and cyclists falling down steep slopes could lead to them being injured. The scheme proposes a new footway / cycleway along the southern verge of Yarnfield Lane. In some locations, the footway / cycleway appears to be located close to the top of steep slopes. In these locations, there will be an increased risk of pedestrians and cyclists falling down the steep slopes, which could lead to them being injured.	It is recommended that measures be introduced to prevent pedestrians and cyclists falling down steep slopes that are adjacent to the footway / cycleway.	Accept Measures will be provided to reduce the risk.
3.4	Risk of pedestrians and cyclists being struck by vehicles, leading to them being injured. The scheme proposes a new footway / cycleway along the southern verge of Yarnfield Lane. The terminal points of the facility are at chainages 0m and 1203m. There are no	It is recommended that suitable terminal points are provided on the footway / cycleway to allow pedestrians and cyclists to join and leave the facility.	Agreed – the alignment design will be updated to provide suitable termination points in line with best practice.

No.	RSA Problem	RSA Recommendation	Design Organisation Response
	details of how pedestrians and cyclists are to join or leave the facility, or what the facility links to. Therefore, as they join or leave the facility, pedestrians and cyclists could be in conflict with vehicles, leading to collisions and associated injuries.		

17 WCHAR

17.1 WCHAR Assessment

- 17.1.1 A Walking, Cycling and Horse-riding Assessment (2EW02-KIC-HW-ASM-WS05-000001) has been carried out for Site 1.
- 17.1.2 The opportunity of including a shared-use footway/ cycleway was highlighted in this assessment.
- 17.1.3 A WCHAR exemption file note has been produced for Site 1a. This is due to the scope of Site 1a only including the temporary localised widening of Yarnfield Lane, and will not have a permanent impact on walkers, cyclists or horse-riders.

18 Traffic Management

- 18.1.1 Traffic management shall be applied for during detailed design Stage but will not be implemented until the Construction Stage.
- 18.1.2 Traffic management will be the responsibility of Kier and will be subject to approval from the Local Authority.
- 18.1.3 Please Refer to Section 26.4 for further information.

19 Statutory Undertakers

19.1 Statutory Utilities

- 19.1.1 Details of all utilities that may be affected by the works are shown on the utility drawings.
- 19.1.2 These utilities are based on the GPR survey that has been undertaken as part of the scheme and the C2 statutory undertaker returns.

19.2 Highway and Drainage Utilities

- 19.2.1 Existing highways drainage infrastructure has been discussed in Section 12.
- 19.2.2 Information on the existing networks have been picked up in the GPR surveys and searches with utility providers.
- 19.2.3 Staffordshire County Council were unable to provide any information on existing drainage.

19.3 Impact of Utilities on the Design

- 19.3.1 Proposed Utility diversions are high level only as feedback from all utility providers has not yet been received and there is no ground investigation data available. These proposals will be further developed in conjunction with the utility providers at detailed design stage, and on review of ground investigation data.
- 19.3.2 Discussions have taken place with Distribution Network Operator (DNO) National Grid (formerly known as Western Power Distribution (WPD)), regarding new electricity supplies to the IMB-R. National Grid have provided information on the proposed route from Meaford and along Yarnfield Lane into the IMBR terminating at a new Auto Transformer Station (ATS) within the IMBR.
- 19.3.3 Based on the demands of the permanent site, it will be necessary to provide new 33kv supplies along Yarnfield Lane. An allowance for electricity joint pits (4.0m x 1.8m) at an approximate spacing of 220m will be required along the proposed Yarnfield Lane alignment.
- 19.3.4 In conjunction with the new electricity supply from Meaford, it will be necessary to divert existing 33kv and 11kv underground and overhead apparatus that run along or cross Yarnfield Lane. The proposed diversions summarised in the ACD Stone Area

Electricity Review (CA3) document reference 2ER05-ARP-UT-NOT-A000-000004, have also been allowed for within the proposed Yarnfield Lane utilities corridor. It is expected that the new supply ducts and proposed diversions can be accommodated within the proposed cycleway and verge.

- 19.3.5 It is expected that temporary power supplies for construction compounds, workers accommodation and other works for the IMBR will be provided from the new ATS or from existing HV supplies within Yarnfield Lane via a transformer.
- 19.3.6 Typical cross sections have been produced along the proposed Yarnfield Lane alignment indicating the location and clearances of the proposed new supplies and diversions along with schematic plans showing the layouts of the proposed utilities.
- 19.3.7 Discussions have also taken place with Severn Trent Water (STW) developer services and new connections team for permanent and temporary water supplies to the site. STW have confirmed that a new connection from the existing 450mm diameter Trunk main or the proposed diversion around the IMBR is not permitted.
- 19.3.8 An alternative option is a connection from an existing 125mm distribution main west of the M6 at the junction of Yarnfield Lane and Moss Lane however, National Highways will not permit a route across the Yarnfield Lane M6 overbridge structure.
- 19.3.9 Another option considered is a potential supply from a 200mm distribution main east of the M6 at the junction with the A34 at Fillybrook. The latter option will require installing a new main within Yarnfield Lane for an approximate distance of 1.6km.
- 19.3.10 Discussions have taken place with Zayo regarding the diversion of their fibre optic apparatus that currently crosses farmland and along Yarnfield Lane. Multiple ducts have been allowed for within the proposed Yarnfield Lane corridor with adequate separation to the adjacent HV cables along the proposed Yarnfield Lane alignment.
- 19.3.11 The design of the scheme is constrained by factors such as geometry and lands available. Any interface between utilities and the proposed scheme has required the utilities to be diverted instead of modifying the scheme design in most instances.
- 19.3.12 At the time of writing clash detections have been carried out on the basis of the level detail on the utility diversion proposals provided to the consultant.
- 19.3.13 All Utilities (overheads or underground) that are associated with the design must be either diverted or protected.

20 Undertakings and Assurances

20.1 Undertakings and Assurances Provided

20.1.1 The Register of Undertakings and Assurances (U&A) for this scheme is contained in the document '2EW02-KIC-AU-SCH-A000-000001'.

20.1.2 The following U&A items are extracted from document 2EW02-KIC-AU-SCH-A000-000001 and are specific to Site 1 only.

Table 31: Site 1 U&As

CCP ID	UA Reference number	U&A Summary
U&A_2a.1618	C64.12	Liaise with farmer re proposed drainage affecting the specified land.
U&A_2a.463	C9.7	Complete the construction and commissioning of the M6 Slip Roads as soon as reasonably practicable in the main civil engineering works construction programme for the Proposed Scheme.
U&A_2a.2256	C100.7	Undertake further traffic surveys and engage with local highway and traffic authorities about the speed limit on Yarnfield Lane.

20.1.3 The following U&A items are extracted from document 2EW02-KIC-AU-SCH-A000-000001 and are generic for all ECW2 sites.

Table 32: ECW2 U&As

CCP ID	UA Reference number	U&A Summary
U&A_2a.469	C9.13	Minimise the loss of existing hedgerows
U&A_2a.2219	A215	Protect and retain ancient and veteran trees where reasonably practicable
U&A_2a.117 U&A_2a.118	A39, A40	Ensure inclusive design and the latest standards relating to this are embedded in the design process
U&A_2a.118	A40	Ensure inclusive design and the latest standards relating to this are embedded in the design process
U&A_2a.1316	C100.1	Engage with cycling groups during the design process where appropriate

CCP ID	UA Reference number	U&A Summary
U&A_2a.1317 U&A_2a.217	C100.2, A72	Ensure the latest cycling standards and guidance are embedded into the design process.
U&A_2a.695	C50.2	Avoiding damage to or loss of ancient woodland or ancient and veteran trees.
U&A_2a.1282	C50.7	Ensure that Ecology Site Management Plans, as described in High Speed Two Phase 2a Information Paper E2: Ecology, are prepared at the detailed design stage in respect of any ancient woodland compensation areas
U&A_2a.1303	C98.1	Fulfil as far as reasonably practicable no net loss of habitats.
U&A_2a.1327	C102.1	Engage with North Staffordshire Bridleway Association if any bridleway networks in community areas CA3, CA4 and CA5 are affected.
U&A_2a.1364	C102.2	Consider designing bridleways to a higher standard where reasonably practicable and appropriate.
U&A_2a.232	A128	Engage with the Environment Agency, Natural England, Lead Local Flood Authorities, the Canal & River Trust and water companies, to ensure that likely residual significant adverse effects are managed and mitigated appropriately.
U&A_2a.234	A129	Land drainage. Inspect the site with the landowner, record locations of existing drainage to be disturbed, ensure the efficiency of drains will not be degraded, produce as-built drawings, use a drainage consultant with local knowledge where appropriate.
U&A_2a.244	A134	Sustainable reuse of displaced soils
U&A_2a.246	A136	Detailed Construction Area Wide Soil Resource Plans for the construction areas of the schemes
U&A_2a.250	A140	Carry out soil surveys PRIOR to stripping soil for storage, ensure that the surveys include sources, contents and volumes to be stripped & stored.
U&A_2a.396	A174	Comply with the environmental minimum requirements
U&A_2a.1372	A179	Water resources and flood risk monitoring undertaken in consultation with the Environment Agency and other key stakeholders is taken into account when designing / constructing any of the works.
U&A_2a.1378	A186	Ensure that the designs include assessments of the impacts of climate change on interdependencies between the Proposed Scheme and other organisations such as infrastructure operators

CCP ID	UA Reference number	U&A Summary
U&A_2a.1380 U&A_2a.1381	A188, A189	Calculate the carbon footprint of the Proposed Scheme. Ensure the low carbon options are considered during design.
U&A_2a.1723	A192	Identify any private properties likely to be impacted by the works. Plan how alternative supplies will be provided.
U&A_2a.1717 U&A_2a.1718 U&A_2a.1719 U&A_2a.1720	A206, A208, A209, A210	Archaeological impacts including the use of industry standards and guidance. Publication of any investigations. Work with Historic England. Identify suitable repositories with Historic England and the Local Authority if appropriate.
U&A_2a.104	A31	Ensure early discussions with the appropriate planning authorities
U&A_2a.105	A32	Public engagement during the detailed design process.
U&A_2a.120	A42	Utility diversions
U&A_2a.144 U&A_2a.152 U&A_2a.150 U&A_2a.149 U&A_2a.148	A94, A95, A97, A98, A99	Take all reasonable steps to design and construct altered roads, and to design, construct, operate and maintain the operational railway so that the combined airborne noise from these sources, predicted in all reasonably foreseeable circumstances, does not exceed the lowest observed adverse effect levels set out in Table 1 of Appendix B. Where this is not practicable the airborne noise should be reduced as far as reasonably practicable. Contribute to the improvement of health through the control of airborne noise.

21 Geotechnical Conditions

21.1 Ground Conditions

- 21.1.1 The ground investigation (GI) has not currently been undertaken. The proposed GI is outlined in the Site 1: Ground Investigation Scope Report (GISR) document (2EW02-KIC-HW-REP-WS05-000006).
- 21.1.2 Detailed ground models will be derived following the completion of the proposed GI and included in the ground investigation report (GIR).
- 21.1.3 A review of the available existing GI is included in the Site 1: Preliminary Sources Study Report (PSSR) (2EW02-KIC-HW-REP-WS05-000005).
- 21.1.4 The Mercia Mudstone Group is present throughout the scheme and is likely to be the founding medium for earthworks and for the bridge. Alluvial soils appear to be very limited in extent, primarily in proximity to the brook course on the west side of the M6. It is reasonable to interpret that they would have been removed beneath the footprint of the M6 during construction of the motorway.
- 21.1.5 Groundwater is anticipated at an elevation of 106.4 m AOD (ML221-CR124).
- 21.1.6 The near surface clay materials are assessed as Class 2A wet cohesive material. Less weathered material from greater depth may fall into class 2C (stony cohesive).
- 21.1.7 Further information on the ground conditions, including a record of the previous exploratory works, is available in the Statement of Intent (Sol) (2EW02-KIC-GT-REP-WS05-000001).

21.2 Cuttings

- 21.2.1 Cuttings are only proposed along the realignment of Yarnfield Lane. These will generate the majority of site-won material for re-use in earthworks.
- 21.2.2 Taking into account the groundwater level and angle of shearing resistance, preliminary cutting side slopes within the Mercia Mudstone clay materials are advised as 1(v):2.5(h), the material is assessed to have a low swell/heave potential.
- 21.2.3 Given the high groundwater level, consideration will need to be given to drainage of any cuttings and because of the flat topography, low spots may require positive drainage of the carriageway.

21.3 Embankments

- 21.3.1 Taking into account the angle of shearing resistance, preliminary embankment side slopes formed of re-used Mercia Mudstone clay materials are advised as 1v:2.5h. Because of the low strength of the near surface clays, a starter/drainage layer is strongly recommended.

21.4 Subgrade and Capping

- 21.4.1 A design subgrade surface modulus value of 30 MPa is advised for the clay component of the Mercia Mudstone Group.

22 Geo-environmental Technical Conditions

- 22.1.1 The ground investigation (GI) has not currently been undertaken, so information is limited to that provided as part of the existing HS2 GI.
- 22.1.2 No environmental tests have been undertaken on the Mercia Mudstone Group.
- 22.1.3 The results of the chemical testing are indicative of a Design Sulphate Class of DS-1 with an Aggressive Chemical Environment for Concrete (ACEC) class of AC-1 for mobile groundwater. However, for design it is advised further ground investigation is undertaken to verify the results and the class of concrete be increased to DS-2, AC-2 for preliminary design.

23 Landscape

23.1 Design Objectives and Strategy

23.1.1 The landscape design shows the relationship of existing vegetation to adjoining proposed planting on the highway and adjacent land. It is designed to assist with the integration of the HS2 Enabling Works within its receiving landscape setting. Table 30 below outlines the design strategy.

Table 33: Landscape Design Objectives

No.	Landscape Design Objective	Design Strategy
1	To reflect the landscape character in which the scheme is located by responding to the local characteristics of the receiving landscape including topography and landscape pattern.	• To respect the local landscape pattern through appropriate planting i.e woodland blocks (see Table 30 for details) and hedged field boundaries blocks (see Table 29 for details). • To use locally native plant species. • To use timber in structures to compliment the rural and distinctive character of the local area.
2	To maintain connectivity and to increase areas of broadleaved woodland and hedgerows within the local area.	• To include areas of broadleaved woodland to mitigate the effects of vegetation loss and reflect the local landscape setting. • Reinststate and enhance field boundaries to reflect the local landscape pattern, mitigate the effects of hedgerow loss and maintain connectivity.
3	To provide new routes and maintain linkage to existing networks for non-motorised users.	• To provide new footpath routes to connect with existing and provide opportunity for circular walks. • Maintain connectivity between settlements and the surrounding area.
4	To restore distinctive landscape character adjacent to the road.	• Reinststate field boundaries with the use of native species next to the road. • In areas not suitable for native woodland planting or hedgerows, wildflower meadows or species rich low-growing grass verge mix (see Table 1 for details) will be used as groundcover.
5	Enhance local biodiversity.	• All groundcover types have been selected to make the greatest contribution to local biodiversity enhancement.
6	Carbon sequestration.	• The introduction of woodland planting and hedgerows where possible and feasible will help to reduce the carbon footprint of the project.

No.	Landscape Design Objective	Design Strategy
7	To use fencing types marrying in with adjacent ones and to plant and seed species and mixes that integrate visually with existing vegetation and for conservation interest.	• Use timber post and wire fences appropriate to local character to assimilate with existing fenced field boundaries.

23.2 Groundcover Species Mixes

Table 34: Grass Verge Low-growing Wildflower Mix

Type	Species	% of mix*	Growth Height
Wildflowers	<i>Hypochaeris radicata</i>	0.8%	15 - 50cm
	<i>Centaurea cyanus</i>	2.0%	20 - 80cm
	<i>Primula veris</i>	0.4%	15 - 30cm
	<i>Myosotis arvensis</i>	1.0%	20 - 40cm
	<i>Leontodon autumnalis</i>	1.2%	15 - 20cm
	<i>Leontodon hispidus</i>	1.3%	15 - 35cm
	<i>Plantago media</i>	0.8%	15 - 45cm
	<i>Lychnis flos-cuculi</i>	0.2%	30 - 90cm
	<i>Prunella vulgaris</i>	1.0%	15 - 30cm
	<i>Rumex acetosella</i>	0.4%	20 - 40cm
	<i>Linaria vulgaris</i>	0.2%	30 - 90cm
	<i>Lotus corniculatus</i>	1.0%	10 - 40cm
	<i>Anthyllis vulneraria</i>	1.0%	15 - 50cm
	<i>Achillea millefolium</i>	0.2%	20 - 100cm
	<i>Rhinanthus minor</i>	2.0%	25 - 50cm
Grasses	<i>Agrostis castellana</i>	4.0%	50 - 100cm
	<i>Agrostis stolonifera</i>	4.0%	40 - 100cm
	<i>Cynosurus cristatus</i>	34.0%	30 - 60cm
	<i>Festuca ovina</i>	20.0%	15 - 50cm
	<i>Poa pratensis</i>	8.0%	30 - 90cm
	<i>Phleum pratense ssp Bertolinii</i>	10.0%	50 - 100cm

Table 35: Native Hedgerow Mix

Type	Species	% of mix*	Growth Height
Native Hedge Plants	<i>Acer campestre</i>	5.0%	40 - 60cm
	<i>Cornus sanguinea</i>	2.5%	40 - 60cm
	<i>Corylus avellana</i>	10.0%	60 - 80cm
	<i>Crataegus monogyna</i>	25.0%	60 - 80cm
	<i>Euonymus europaeus</i>	2.5%	40 - 60cm
	<i>Ilex aquifolium</i>	5.0%	40 - 60cm
	<i>Ligustrum vulgare</i>	5.0%	40 - 60cm
	<i>Malus sylvestris</i>	2.5%	40 - 60cm
	<i>Prunus spinosa</i>	25.0%	60 - 80cm
	<i>Rosa arvensis</i>	2.5%	40 - 60cm
	<i>Rosa canina</i>	5.0%	40 - 60cm
	<i>Ulmus glabra</i>	5.0%	40 - 60cm
	<i>Viburnum opulus</i>	5.0%	40 - 60cm

Table 36: Native Woodland Mix

Type	Species	% of mix*	Growth Height
Native Woodland Mix	<i>Betula pendula</i>	15.0%	80 - 100cm
	<i>Corylus avellana</i>	10.0%	80 - 100cm
	<i>Crataegus monogyna</i>	5.0%	80 - 100cm
	<i>Malus sylvestris</i>	5.0%	80 - 100cm
	<i>Quercus petraea</i>	5.0%	80 - 100cm
	<i>Quercus robur</i>	15.0%	80 - 100cm
	<i>Sambucus nigra</i>	5.0%	80 - 100cm
	<i>Sorbus aucuparia</i>	5.0%	80 - 100cm
	<i>Ulmus glabra</i>	10.0%	80 - 100cm
	<i>Viburnum opulus</i>	2.5%	80 - 100cm
	<i>Prunus spinosa</i>	1.3%	80 - 100cm
	<i>Crataegus monogyna</i>	5.0%	60 - 80cm
	<i>Malus sylvestris</i>	5.0%	60 - 80cm
	<i>Sorbus aucuparia</i>	2.5%	60 - 80cm
	<i>Viburnum opulus</i>	2.5%	60 - 80cm
	<i>Prunus spinosa</i>	1.3%	60 - 80cm
	<i>Ilex aquifolium</i>	5.0%	40 - 60cm

23.3 Landscape Design Considerations

- 23.3.1 Across Site 1 where sightlines need to be maintained, a low growing species-rich grass verge mix, as shown in Table 31, is used.
- 23.3.2 On the embankments, where slopes of 1 in 2.5 will make establishment of shrubs and trees difficult, a wildflower mix (the composition of which is still to be determined) will be established that will be allowed to grow to its full height and cut once or twice per season.
- 23.3.3 Wherever possible woodland mix (see Table 33 for details) has been added to areas between either the grass verges or slopes to the edge of the project area. Areas where this principle was not applied included areas where known future development would result in the removal of this tree planting, areas where the project boundary line is still to be finalised, drainage issues or where future ownership may not be compatible with this ground cover type. Wildflower mix has been applied to all these areas, but this will be revisited at detailed design stage.
- 23.3.4 Where appropriate native species rich hedgerow (Table 32) will be planted along the proposed new fence line or along the site boundary.
- 23.3.5 Additional standard trees may be added into the hedgerow or wildflower areas at the detailed design phase once the exact location of the fence line has been confirmed.

24 Environmental Considerations

Environmental Considerations:

Mod Site 1 – Phase 1 Ecological Report (2EW02-KIC-EV-REP-WS05-000004)

- 24.1.1 The Phase 1 habitat survey identified that Site 1 comprises predominantly arable land, with areas of neutral grassland, broadleaved woodland, amenity grassland, and poor semi-improved grassland.
- 24.1.2 The habitats present within and adjacent to the site are suitable for badgers, bats, breeding birds, barn owl, hazel dormouse, reptiles, otters, water vole, white-clawed crayfish, aquatic invertebrates and native fish species.
- 24.1.3 The Preliminary Bat Roost Assessment identified 100 trees and three buildings with the potential to support bat roosts.
- 24.1.4 [REDACTED]
- 24.1.5 The requirement for precautionary working methods, further surveys and protected species licensing with regards to the above species will be considered at detailed design stage and in accordance with the findings of the Phase 1 Ecological Report.

Heritage Considerations:

- 24.1.6 There are no items of heritage significance across the Site 1 highways footprint. However, given the large area, an extensive programme of trial trenching has been planned to further investigate. The scope and methodology for this is set out in the Location Specific Written Scheme of Investigation (LSWSI) for Stone Infrastructure Maintenance Base-Rail (IMB-R) (2EW02-KIC-EV-REP-A000-000018).

Arboricultural Considerations:

Site 1 – Yarnfield Bridge Stage 1 Tree Survey Report (2EW02-KIC-EV-REP-WS05-000015)

- 24.1.7 The site is not located within 100m of ancient woodland so there is no requirement to consult with the Woodland Trust.
- 24.1.8 There are some mature trees along Yarnfield Lane, although the Stage 1 Tree Survey has confirmed these are not veteran or ancient trees of arboricultural significance. This account will be updated on review of the completed Stage 1 report for Site 1 when it is available.

- 24.1.9 A Phase 2a scheme wide desktop screening exercise has also been carried out to identify the risk of adverse operational noise impacts as a consequence of the road modification works. This has been used to identify what additional noise assessment works are likely to be required at detailed design stage.
- 24.1.10 There are some receptors in relative close proximity to the road modifications and the realigned road will move closer to other receptors. However, it is likely that the existing high ambient noise levels from the M6 will reduce the magnitude of this.
- 24.1.11 The risk of adverse operational noise impacts is Medium at Site 1. This will be further investigated at detailed design stage through a more focussed desk- based assessment. A quantitative assessment of operational noise impacts is likely to be required to assess the level of impact and identify if mitigation is required.

25 Stakeholders

25.1 Key Stakeholders - County, Local & Parish Councils and Local Authorities

25.1.1 The following are key stakeholders on the scheme:

- National Highways (NH);
- Staffordshire County Council (SCC); and
- Yarnfield and Cold Meece Parish Council.

25.1.2 Regular workshops are held with NH and SCC on a monthly and fortnightly basis (respectively). Minutes and actions from these meetings are recorded and distributed.

25.1.3 There have been two engagement meetings to date with Yarnfield and Cold Meece Parish Council. The key issues highlighted by the parish include:

- The proposed carriageway width of Yarnfield Lane – which has been resolved through communicating the increase in proposed carriageway width from the originally proposed 6.0m to 6.8m in the second engagement meeting;
- The provision of an NMU - which has been resolved through communicating that the shared footway/ cycleway will be incorporated into the southbound side of Yarnfield Lane;
- Their opportunity to review and provide feedback on the design prior to its construction – which has been resolved through communicating that the scheme is only at scheme design stage and that the design drawings will be provided to the parish following the completion of scheme design; and
- Concern of the construction staging to minimise traffic disruption – this has not yet been resolved but can be in future engagement sessions when the construction programme has been further developed.

26 Buildability Review

26.1 Site set up

- 26.1.1 HUB 2 will be used for the works at Site 1 including Yarnfield Bridge, Site 1A and Site 18.
- 26.1.2 Access to HUB2 can be accommodated via A34 and Yarnfield Lane or via the M6 slip roads.



Figure 9: HUB 2 Access

- 26.1.3 On the east side of the M6, as part of the HUB 2, office and welfare arrangements will be available within a fenced compound facility.
- 26.1.4 On the west side of the M6, a self-contained welfare facility with suitable site fencing shall be provided.
- 26.1.5 Vehicles will park in the above compound locations.
- 26.1.6 On the east side of the M6, plant will park at the HUB 2.
- 26.1.7 On the west side of the M6, plant will be left at the work site. Site security will be required.

- 26.1.8 There are no walking routes through the site.
- 26.1.9 On the east side of the M6, the provision of skips and stockpile area will be available in HUB 2.
- 26.1.10 On the west side of the M6, most of the waste and required materials will be taken from/delivered to the source. Some waste will be skipped at HUB 2
- 26.1.11 On the east side of the M6, as all vehicles will be coming in and out via HUB 2, a wheel wash will be installed at the access point.
- 26.1.12 On the west side of the M6, vehicles will have to be kept to clean routes to negate the need for a wheel wash, due to working area constraints.
- 26.1.13 Mobile fuelling of vehicles will be used to reduce the risk of theft and need for storage space. Small tools will be centrally stored in the compounds and deployed as required.

26.2 Programme

26.2.1 The following table illustrates the latest indicative programme dates.

Table 37: Programme Dates

	Start	End
<u>HUB 2 - preparation works</u>	30/10/2023	29/03/2024
<u>Site 1</u>		
North / West side	08/04/2024	18/10/2024
Excavation for cutting	08/04/2024	19/07/2024
Backfilling	29/04/2024	18/10/2024
Drainage North	20/05/2024	21/06/2024
South / East side	03/06/2024	25/10/2024
<i>Earthworks</i>		
Excavation for cutting	03/06/2024	07/06/2024
Backfilling	10/06/2024	25/10/2024
Drainage South	24/06/2024	26/07/2024
Tarmac North	21/10/2024	15/11/2024
Tarmac South	18/11/2024	29/11/2024
VRS south and north	02/12/2024	07/02/2025
Traffic signs	07/02/2025	01/04/2025
Finishing works	19/03/2025	14/04/2025

26.3 Sequencing

- 26.3.1 The works are planned in several phases to prevent disruption to the existing Yarnfield Lane, stakeholders and the M6 emergency slip roads.
- 26.3.2 It is acknowledged that the National Highway Infrastructure associated with the M6 Motorway all lane running has yet to be shown within the phasing and programme. Regardless of the method of construction it must remain operational at all times. Two options are currently under consideration.
- Install interrupters on the existing NRTS cable to bypass the site temporarily until such time the proposed NH infrastructure has been installed and can be permanently connected to the existing network, or:
 - Install the permanent NH infrastructure while the existing system remains operational and at the appropriate time switch to the permanent layout by jointing the new NERT cable with the existing network.
- 26.3.3 Further design development is required prior to an appropriate solution being selected.

Phase 1:

26.3.4 The **first phase** is working on both sides and building the temporary access roads with the plant crossing at Yarnfield Lane (East):

- Emergency slip roads are remaining in the existing alignment.
- Current public traffic arrangements remain unaffected.

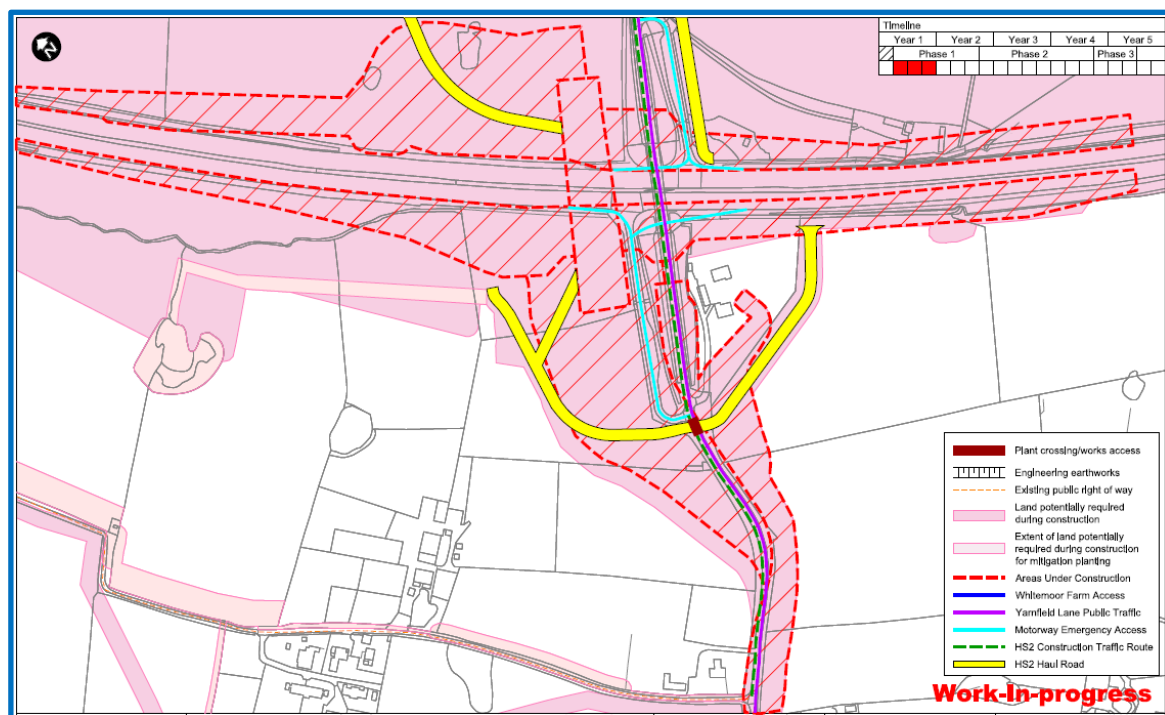


Figure 10: Phase 1 (Sequence)

Phase 2:

26.3.5 The **second phase** will be building the Yarnfield Lane (East) local diversion, Whitmoor Farm Access, Link from the new roundabout to the realigned Yarnfield Lane and extend the temporary access Road where possible:

- Emergency slip roads are remaining in the existing alignment.
- Public traffic diverted onto the temporary realigned Yarnfield Lane.

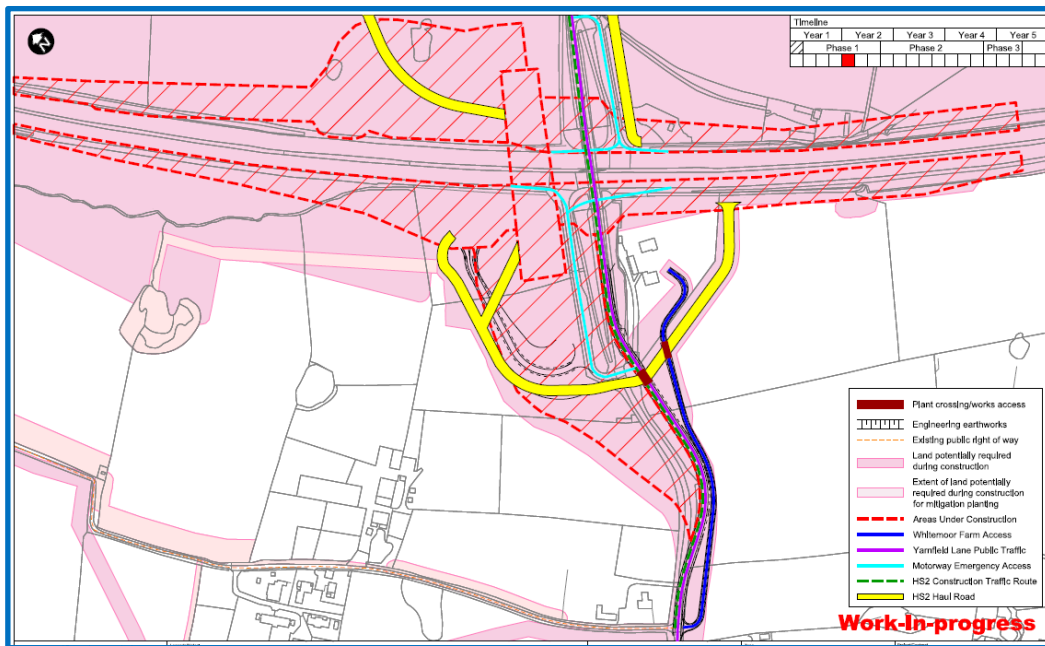


Figure 11: Phase 2 (Sequence)

Phase 3:

26.3.6 The **third phase** is the roundabout on the East and priority junction on the West sides together with the slip roads. Modifying the work access road alignment in the designed position with the plant crossing where needed.

- Emergency slip road on the East is diverted onto the new realigned junction and the West side remains unaffected.
- Public traffic using the temporary realigned Yarnfield Lane.
- Start with earthworks for the new Yarnfield Bridge.

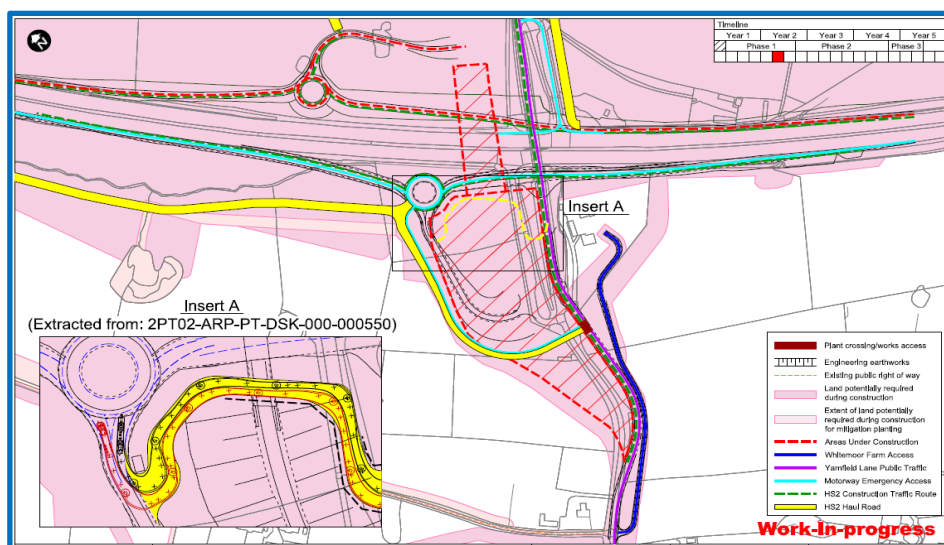


Figure 12: Phase 3 (Sequence)

Phase 4:

26.3.7 The **fourth phase**, working on the new realigned Yarnfield Lane embankment and cutting together with all associated drainage activities. Modifying the temporary access road alignment.

- Emergency slip road on the South is diverted between the abutment and the pier joining the existing Yarnfield Lane in front of the existing bridge, no changes on the north side.
- Public traffic still using the temporary realigned Yarnfield Lane.
- Proceed with the works on the new Yarnfield Bridge.

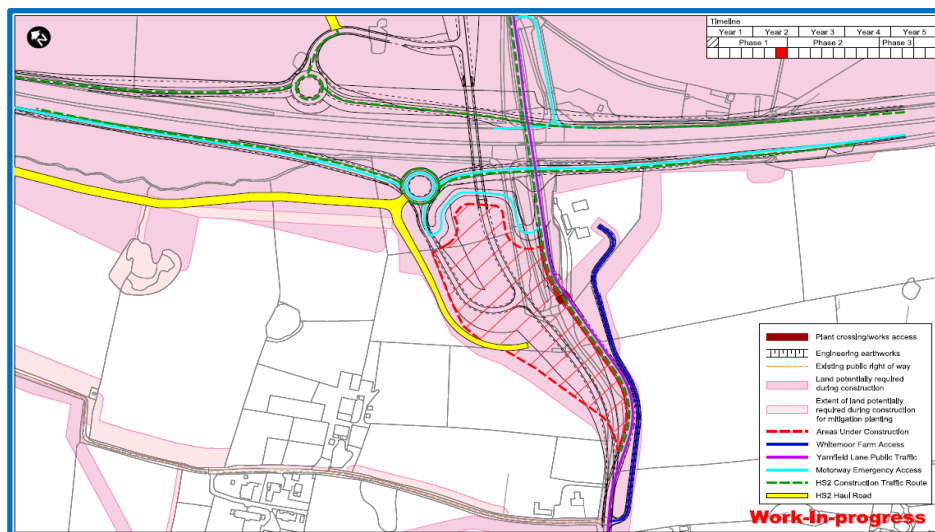


Figure 13: Phase 4 (Sequence)

Phase 5:

26.3.8 The **fifth phase**, at this stage the new bridge should be completed as well as all works related to the new realigned Yarnfield Lane, including:

- Public traffic diverted across the new Yarnfield Bridge and new realigned road.
- The existing bridge at this stage can become a haul road crossing above the M6 motorway.
- Emergency slip roads diverted to the new realigned roads.

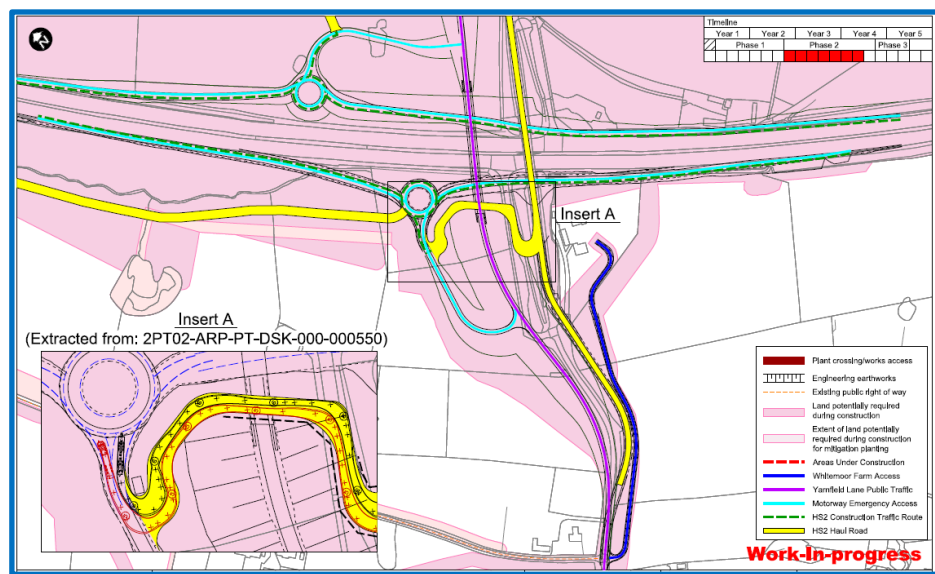


Figure 14: Phase 5 (Sequence)

26.3.9 The above sequence is based on most of the works to be completed offline and this will minimise the need of full carriageway closures. A series of full closures will be required on Yarnfield Lane and the M6 to complete some of the bridge and highway elements.

26.4 Traffic Management

26.4.1 The traffic management envisaged to complete the works includes:

- Temporary traffic lights for the works for Yarnfield Lane (on the east side of the M6)
- A full closure will be required when completing the works for Yarnfield Lane (on the west side of the M6)

26.4.2 Majority of the Site 1 works are away from the existing Yarnfield Lane which doesn't require any traffic management. For the Utility diversions/protection full closures (East and West) will be required to complete these works. This applies for both above and underground services. Full closures will also be required for the road tie-ins. For undertaking the slip roads along the northbound and southbound M6 on both sides, a combination of full phased closures, lane closures and narrow lanes will be required.

26.5 Traffic / Haulage routes

26.5.1 Works will be undertaken in accordance with the Environmental statement, using the A34, Yarnfield lane and the emergency slip roads at the Yarnfield junction.

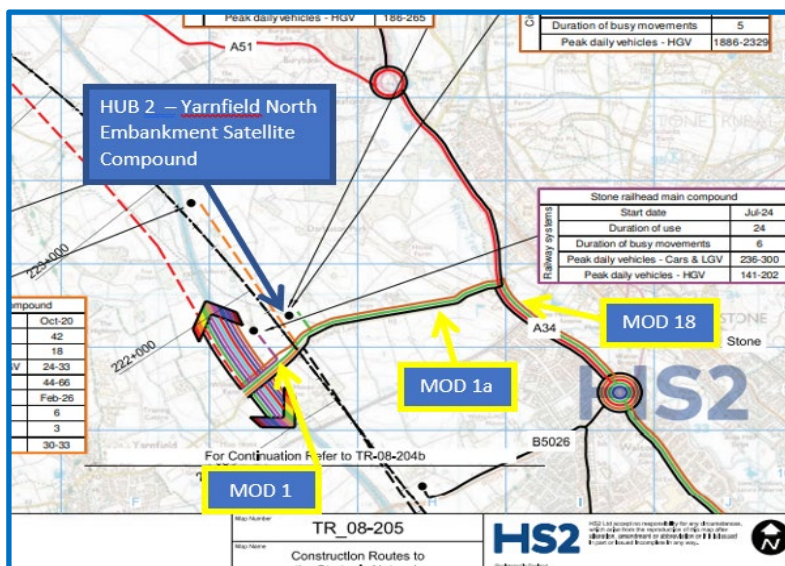


Figure 15: Haulage Routes)

27 Whole Life Cost

27.1.1 Whole life cost has been an important consideration in the design of the scheme. The below are design decisions that have been taken to minimise whole life cost:

- The alignment of the southbound diverge slip does not change between the HS2 construction phase and the permanent phase (minimising the work to be completed in the permanent phase);
- The alignment changes to the southbound merge slip have been minimised between the between the HS2 construction phase and the permanent phase (minimising the work to be completed in the permanent phase);
- Existing drainage systems (Ditches and pipe networks) have been retained and reused where possible, minimising the construction and new materials required
- Culvert designs take into account the temporary and permanent highway layouts to avoid demolition or reconstruction as the project moves between phases.
- Ditches have been used where possible for the new drainage systems to avoid the requirement for pipes, pipe bedding and manholes.
- Existing cross carriageway pipes have been extended rather than replaced where possible to avoid having to excavate across the live carriageway

Yarnfield Lane – M6 Sliproads

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Appendix A – RRRAP Sheets

LATEST RRRAPS UNAVAILABLE DUE TO NATIONAL HIGHWAY ONLINE SYSTEM FAILURE

OFFICIAL

HS2 Ltd - Code 1 - Accepted

Appendix B – Proposed Relaxations from standards

Table 38: Proposed Relaxations from Standards

Departure No.	Relevant Standard(s)	Clause(s)	Location	Difference between standard(s) and proposed design	Associated departures / relaxations
RE-001	CD 109	2.9 & Table 2.10	Phase 2: Yarnfield Lane from Ch. 0+095.57m to 0+166.86m	Horizontal curve of 180m - Three steps below desirable minimum radius at 85kph design speed	RE-006
RE-002	CD 109	2.9 & Table 2.10	Phase 2: Yarnfield Lane from Ch. 0+319.09m to 0+386.53m	Horizontal curve of 255m - Two steps below desirable minimum radius at 85kph design speed	RE-003
RE-003	CD 109	2.9 & Table 2.10	Phase 2: Yarnfield Lane from Ch. 0+299.94m to 0+640.15m	Vertical curve of K=30 - One step below desirable minimum K Value at 85kph design speed	RE-002
RE-004	CD 109	2.13	Yarnfield Lane Junction- Maintenance Road to M6 NB Ch. 0+291	Stopping Sight Distance - Relaxations within immediate approach to junction between Yarnfield Lane and Maintenance Road to M6 (Ch-14-100m. Ch 300 -520m-SSD 2 steps below, 260-300m, SSD 1 step below)	RE-005
RE-005	CD 109	2.13	Yarnfield Lane Junction- Maintenance Road to M6 NB Ch. 0+291	Vertical curve of K=30 - One step below desirable minimum K Value at 85kph design speed	RE-004
RE-006	CD 109	2.13	Phase 2: Yarnfield Lane from Ch. 0+088.00 to 0+100.00m	Stopping Sight Distance - Two steps below desirable minimum from Ch. 0+088.00 to 0+100.00m	RE-001