Objection to Policy E2

Flawed reasoning for de-allocation

Little Park Farm (the Site) was allocated in Local Plan Part 2: Development Sites and Policies (LPP2), adopted in June 2015, under Policy DSP18 and its related development brief E2. It established at that point that the site was suitable for economic development. This has been re-confirmed by The Site Options Assessment Report (SOAR) which provides the sustainability context to the consideration of which potential development sites should be allocated to deliver the Local Plan strategy. The SOAR re-confirms the Site's allocation would not be harmful to the strategy; indeed, in some instances it would either have a likely positive effect or a likely strong positive effect.

The Strategic Appraisal and Strategic Environmental Assessment (SASEA) examination of alternative allocations for employment development is justified partly on the basis of Little Park Farm having a problematic site access, affecting its deliverability. Thus, the reasons for the selections of Options 1, 2, 3 and 6 are partly because of this and likewise so to the reasons for rejection of Options 4 and 5. It therefore follows if the basis of the SASEA Alternative Options partly rests on the consideration of the suitability of the access of Little Park Farm and if that assumption is incorrect it means that the SASEA is flawed. And if SASEA is flawed it would mean that the draft Fareham Local Plan 2036 is Unsound.

The suitability of the access is examined further in the SASEA. It rejects the Site because *"no highway access solution is identified*". There is no source given to explain, how, where or why this assessment has been made.

However, the Strategic Employment Land Available Assessment (SELAA) on Little Park Farm under Transport Comments states:

Site access is via a 3.7m wide rail underbridge, which would require control measures for vehicles and pedestrians. Traffic signals would appear to be feasible, linked to a separate pedestrian phase. There is a potential vulnerability if the underbridge became obstructed, such as by a large/high vehicle.

The Transport Comments do not make any further analysis on intensity of use. But regardless of this, under the heading "Suitability of the Site", the conclusion is reached that a significant highway solution is potentially unviable but no explanation has been given as to how or why this conclusion is reached. No discussions have taken place either with the developer or agent.

It is therefore incorrect for the SASEA to state that no highway access solution is identified. A highway solution has been identified as is clear from the SELAA. Thus, the deallocation has been justified on flawed reasoning.

Even if the de-allocation had been advanced on the basis that the highway solution was potentially unviable then a proper assessment should have been undertaken. In the event, no such assessment has been carried out. However, it can be clarified that there is a viable highway solution.

The proposed solution to improving the access involves lowering the existing carriageway under the bridge to provide a maximum vehicle height clearance of 4.325m but allowing for a for a 75mm safety margin, the maximum permitted height would be 4.25m.

The design of this solution has been signed off by Network Rail. This is documented as attachment F003. Details, plans and calculations of the design are attached and are listed as follows:-

- Statement of Design Intent F002
- Certificate of Design and Check F003
- Calculations
- Designer's Risk Assessment
- Bridge Plan Road, Arrangement and Sections 010A
- Longitudinal Sections and Details 011A
- Sequence of Works 012A
- Height Warning Restriction 013A
- Document Review Notice
- Image 9476
- Image 9479
- Railton TPC Ltd

The design solution proposed is viable, realistic and practical and can easily be delivered within a very short time frame.

The Railton TPC Ltd report indicates that this design solution would allow for the majority of HGV types to negotiate the access and would mean that the Site would be accessible by European standard height haulage HGVs.

The proposed scheme is considered to be the most pragmatic and cost effective solution of ensuring that the traffic generated by the proposed floor area allocation can be served by the access.

This is not to say that the access cannot be improved further as the Railton TPC Ltd report reveals but the proposed scheme is considered as being the best value for money while ensuring the floor area capacity can be supported by the access improvements.

An interim solution is also proposed, which can be achieved in a shorter timeframe, involving undertaking a scrape at the underbridge, increasing the headroom by 3.795m (which includes a safety margin allowance).

It is therefore contended that as there is a feasible highway solution, the SASEA is flawed and therefore the deselection of the Site is unsound. Furthermore, as there is a viable solution the evidence presented in the SELAA is also incorrect.

In considering what factors are relevant to assessing the suitable of sites/broad locations of development the NPPG states:-

Sites in existing development plans or with planning permission will generally be considered suitable for development although it <u>may be necessary to assess whether circumstances have changed which would alter their suitability</u>. This will include a re-appraisal of the suitability of previously allocated land…

There is no evidence provided by Fareham Borough Council to show that the circumstances have changed since the allocation of the site in the Local Plan Part 2, 2015. The suitability of the access was assessed as part of the Examination of the allocation and since that time there has now been a scheme approved by Network Rail. So insofar as there have been changed circumstances, the direction of travel is more favourable as there is now an approved detailed design which gives comfort that the access should not be an impediment to the traffic volumes generated by 11,200sq m of floor space.

Accordingly the evidence justifying the deallocation is not substantiated.

<u>Undermining of Strategic Policy</u>

The SESEA, SEA objective 9 is "To strengthen the local economy and provide accessible jobs available to residents of the borough." Linked to this is Strategic Policy 13: Provide a mix of jobs and employment opportunities through protecting and further enhancing viable and important employment areas and providing for the future employment space which is outlined in the SESEA and transposed into the DFLP.

In addition the economic strategy of the DFLP is designed to be flexible, building in an oversupply of floorspace (paragraph 6.18) to ensure a reasonable supply in case there is not the take up.

Thus, the aim of the economic strategy is to be flexible and provide a mix of jobs and employment opportunities. The deallocation of the site would undermine this Strategy.

The original allocation in the LPP2 under Policy DSP18 and Development Brief recognised that the site had potential for up to 11, 200 sq m of B2/B8 uses but considered that the potential for more intensive employment use may be dependent on improvements to the access.

Paragraph 5.25 states that the "Site has potential for economic development uses, *although the existing access may need to be improved in order for <u>more intensive</u> employment development to be considered appropriate* and at Development Brief E2, *"Vehicular access will need to be carefully considered. Current access is from the south via a narrow bridge under the railway line at Little Park Farm Road. This will <u>need to be improved in order for a more intense use of the site to be considered acceptable.</u>*

It is clear from the extract of policy and Development Brief E2 that the access needs only be improved for a more intensive use of the site. In other words, the access does not preclude employment development per se.

Thus bearing in mind that the site is suitable for *an employment use* it is illogical to strike out the allocation on the basis of not being able to deliver an improved access and a more intensive use of the site, as doing so would undermine the SEA objective 9 and Strategic Policy 13 to provide a mix of jobs and employment opportunities and provide flexibility in accordance with paragraph 6.18 of the DFLP. Furthermore, the NPPF states that LPA's should have regard to the quantitative and qualitative needs for all foreseeable types of economic activity. The provision of the site would meet these objectives.

Undermining of the viability of the Site

The NPPF states that Local Planning Authorities should work closely with the business community to understand their changing needs and identify and address barriers to investment, including a lack of housing, infrastructure or viability. It also states that pursuing sustainable development requires careful attention to viability and costs in plan-making and decision-taking. Plans should be deliverable. Therefore, the sites and the scale of development identified in the plan should not be subject to such a scale of obligations and policy burdens that their ability to be developed viably is threatened

Notwithstanding the fact that the Site has been designated as an Employment Area, under Policy E3, the deallocation of the Site undermines investment of the Site because it makes its status uncertain.

At present over £2m has been spent on land acquisition, studies and promotion of the Site. The owner has just embarked on the marketing campaign (see attachment) to develop the Site and has earmarked 2018 for works to be undertaken to the bridge. De-allocation of the Site will put off investors funding the development of the Site as it will ostensibly appear to the ordinary lay person that there is no potential for further development since it is no longer allocated.

Deliverability of Site

In addition, the NPPG, states that in assessing sites an indicative trajectory of the anticipated development and consideration of associated risks should be undertaken. Apart from the Wellborne Employment Development Trajectory this does not appear to have been undertaken. Part of the Site has already been developed for B8 uses under P/15/0262/CU and as indicated above the Site will be deliverable in the short term future. Therefore unlike the other allocations the development of the Site is achievable in the early part of the Plan period.

Duty to Co-operate

The LPA has a duty to Co-operate. The Winchester Local Plan Part 2 allocates part of the Site within Winchester District as an employment allocation under Policy SHUA4. Therefore the deselection of the Site as an allocation undermines this policy and creates a policy mismatch. No evidence is available to show that there is has been any Co-operation between the two LPAs agreeing to the change of approach to the Site.

Proposed Changes to Policy E2

For the above reasons the Site should be re-allocated. Policy E2 should therefore be amended to include Little Park Farm.

Objections/Changes to Policy E1

In the event that the LPA refuses to change its stance and without prejudice to the aforementioned grounds of objection it is requested that the following changes are made to Policy E1 to clarify the status of the Site.

Change Policy E1 from:

- Additional employment sites allocated in this Local Plan

To:

- Additional employment allocations **and employment areas** allocated in this Local Plan

Change Text of Paragraph 6.10 from:

- This total took into account a reduction in the employment floorspace available at Welborne during the plan period from 83,395 sq.m to 35,030 sq.m, as well as the deallocation of Little Park Farm in Segensworth North, due to significant doubts over the deliverability of this site, as a result of the existing vehicular access constraints which have not been overcome. Including floorspace completions and losses, there is a floorspace shortfall of approximately 11,000 sq.m.

To:

- This total took into account a reduction in the employment floorspace available at Welborne during the plan period from 83,395 sq.m to 35,030 sq.m, as well as the floorspace **allotted to Little Park Farm because of potential access constraints**. Including floorspace completions and losses, there is a floorspace shortfall of approximately 11,000 sq.m.

Change Text of Paragraph 6.11 from:

- As such, the approach that is proposed by this Draft Local Plan is one that seeks to retain the existing deliverable employment allocations by re-allocating them; Solent 2, Midpoint 27, Faraday Business Park (Daedalus East) and Swordfish Business Park (Daedalus West). In addition...

To:

- As such, the approach that is proposed by this Draft Local Plan is one that seeks to retain the existing deliverable employment allocations by re-allocating them; Solent 2, Midpoint 27, Faraday Business Park (Daedalus East) and Swordfish Business Park (Daedalus West). **In the case of Little Park Farm, owing to concerns about the access potentially constraining floorspace supply, the site is no longer expected to provide 11.200sq m of floorspace and therefore has not been reallocated under this Policy but instead has been re-assigned as an Employment Area suitable for expansion under Policy E3**. In addition…

<u>Objections to Policy E3</u>

Without prejudice to the objections made under Policy E1 and in the event that Little Park Farm reallocation under this Policy is confirmed, it is requested that the following changes be made to Policy E3 to take account of the change in the status of the Site.

As not all of Little Park Farm is currently lawfully used for employment the policy should be amended.

Change from:

- The Employment Areas as shown on the Policies Map will be protected for employment uses within the use classes B1, B2 and B8.

To

- The Employment Area as shown on the Policies Map will be **safeguarded and promoted** for employment uses within the use classes B1, B2 and B8

Change from

- Proposals for the extension of new buildings and intensification of land for employment uses within an existing Employment Area will be supported where it can be demonstrated that:

To

- Proposals for the extension of new buildings, intensification **and change of use** of land for employment uses within an existing Employment Area will be supported where it can be demonstrated that:

Residential use should not be ruled out. Bearing in mind that Strategic Priority 4 requires fulfilment of the housing supply short/medium term, Strategic Priority 10 requires a sensible and logical urban extension with the ability to provide and maintain a defensible urban edge following development and the NPPF and NPPG requirements to consider existing allocations for other uses it would be sensible to allow residential windfall opportunities in employment areas where there no longer a demand or employment is constrained.

It is therefore requested that the policy be amended

Change from

Proposals for the change of use or redevelopment of vacant land and buildings to uses other than B-class employment (excluding residential)

Change to

Proposals for the change of use or redevelopment of vacant land and buildings to uses other than B-class employment (**including** residential)

Allocation of Land for Residential Use under Policy DA1

The NPPG makes clear that existing allocations should be reappraised and alternative uses considered where circumstances have changed. In deallocating the Site it has not been assessed for other uses, such as residential. Bearing in mind the site scores well on the sustainability indices, and would benefit from its close proximity to Swanwick Station, it is considered that the site has the potential to provide for 6.5ha of residential land even allowing for acoustic screening from motorway noise. Based on a density of 40dph this would around 50 residential units – see attached indicative layout. The site would be suitable for custom/self-build development only.


PRIVATE PROPERTY

Page 1 of 2	Document Review Notice (DRN)					
	Form Ref	NR/L2/INI/02009/F0044	Issue Date	05/09/2015	Issue	8.0

Project Number:	WR4435	**Project Name:**	Hayling Farm Under Bridge
Project Manager:	[redacted]	**Principal Contractor:**	
Engineering Deliverable Owner:		**CEM Name:**	
Submission Discipline:	Building Civils	**CRE Name:**	[redacted]
Document Number:	14-311G	**Revision No:**	1
Document Title:	Forms F002 and F003	**GRIP:**	
NR DPE Name [redacted]		**CSM Significant:**	No
Document Transmittal/Submission No:	WO813		
Date Received:	18/112016	**Date Return Required:**	25/11/2016
REVIEWERS:-	**DRN No:** WE1151	**DRN Date:**	25/11/2016

Name	**Position**	**Discipline**	
[redacted]	Senior engineer	Buildings Civils - (Lead)	[redacted]

DISTRIBUTION LIST (of completed review):-

Name	**Position**	**Action Required**
[redacted]	Scheme Project Manager	Issue to OP
	SAPE	
	APE	

Document Details:	**PDF** ☒	**Source Data** ☐	**Two Dimensional** ☐	**Model** ☐
Number:	**Document Title:**			
Document URL:			**Revision:**	

DOCUMENT REVIEW:-			**Risk Review Level:**	
Overall DRN Category	**Rejected** Non-compliant to contract	**Accepted**	**Accepted** with Amendments	**Not Accepted** Revise & Resubmit
3	0	1	2	3

- Acceptance of these documents by Network Rail is not be deemed as validation of the submission, nor does it infer fitness for purpose. Network Rail does not accept any liability for the submission.
- Any changes to the documents should be undertaken in accordance with change control procedures adopted by individual contracting organisations. Such variations are required to be formally recorded and evidence should accompany any resubmission.
- Without relieving the originating organisation of their contractual responsibilities my comments are as follows:
  - Overall DRN Category 0 rejected and a category 3 non acceptance requires the whole document(s) to be revised and resubmitted to address the comments. Prior to any re-work a way forward shall be agreed between supplier and the Designated Project Engineer
  - Overall DRN Category 2 acceptance with amendments requires the appropriate responses with additional information to be submitted to address the comments
  - Comment type 0 is used to capture comments if the submission is an overall DRN Category 0
  - Comment types 2A, 2B, 3A and 3B require a written response & Comment type 4 is for information only
  - Comment type 5 is used to identify an aspect of a submission which shows a 'Safe by Design' feature
- For comments types 2 or 3 a suffix is added to the comment type: A) Qu [redacted] on or B) Client preference/changes.

****Issued By:**	[redacted]	**Signature:**	[redacted]	**Date:**	25/11/2016

DRN ACCEPTANCE AND/OR CLOSED OUT (including Supplier's responses):-

****Closed By:**		**Signature:**		**Date:**	

**Only to be signed by the Project Designated Project Engineer or person with such formally recorded delegated authority. Review comments to be returned to Supplier via control process agreed between the Project Manager and Supplier.

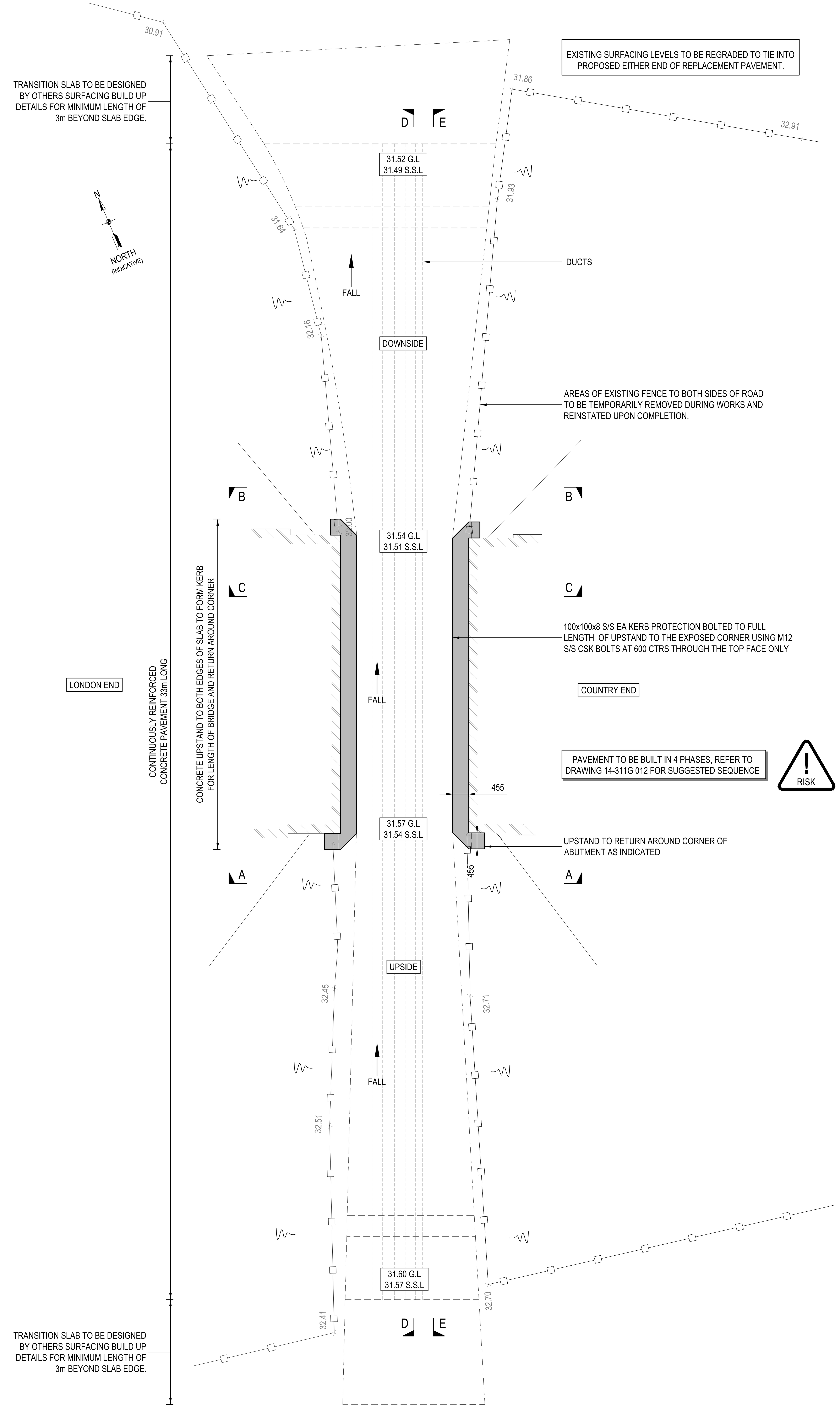
Document Review Notice (DRN)					DRN No: WE1151
Form Reference	NR/L2/INI/02009/F0044	Issue Date	05/09/2015	Issue	8.0

Network Rail (NR)					Supplier			NR
No	Comments	By	Type	Integration Activity	Comment Accepted	Responses	By	Response Accepted *
1	Google streetview shows a wide crack in intrados approximately 1m from North West corner. An investigation should be undertaken to assess cause of cracking. Also any other defects present on the bridge should also identified . Remedial works to the defects identified should be undertaken prior to main works.	AB	3A					
2	Monitoring of the underbridge should be undertaken during construction. The monitoring should be taken on a regular basis, even during night time, preferably using a remote equipment.	AB	2A					
3	The risk assessment did not include the risk of the abutment foundations moving together as a result of the removal of passive restraint. This needs to be addressed with adequate mitigation.	AB	3A					
4	A method statement will be required before the work is undertaken. We would expect emergency propping equipment to be available on site in case any movement was detected in the abutments.	AB	4					
5								
6								
7								

To Perform Spelling Check on the Protected Form Click Here:

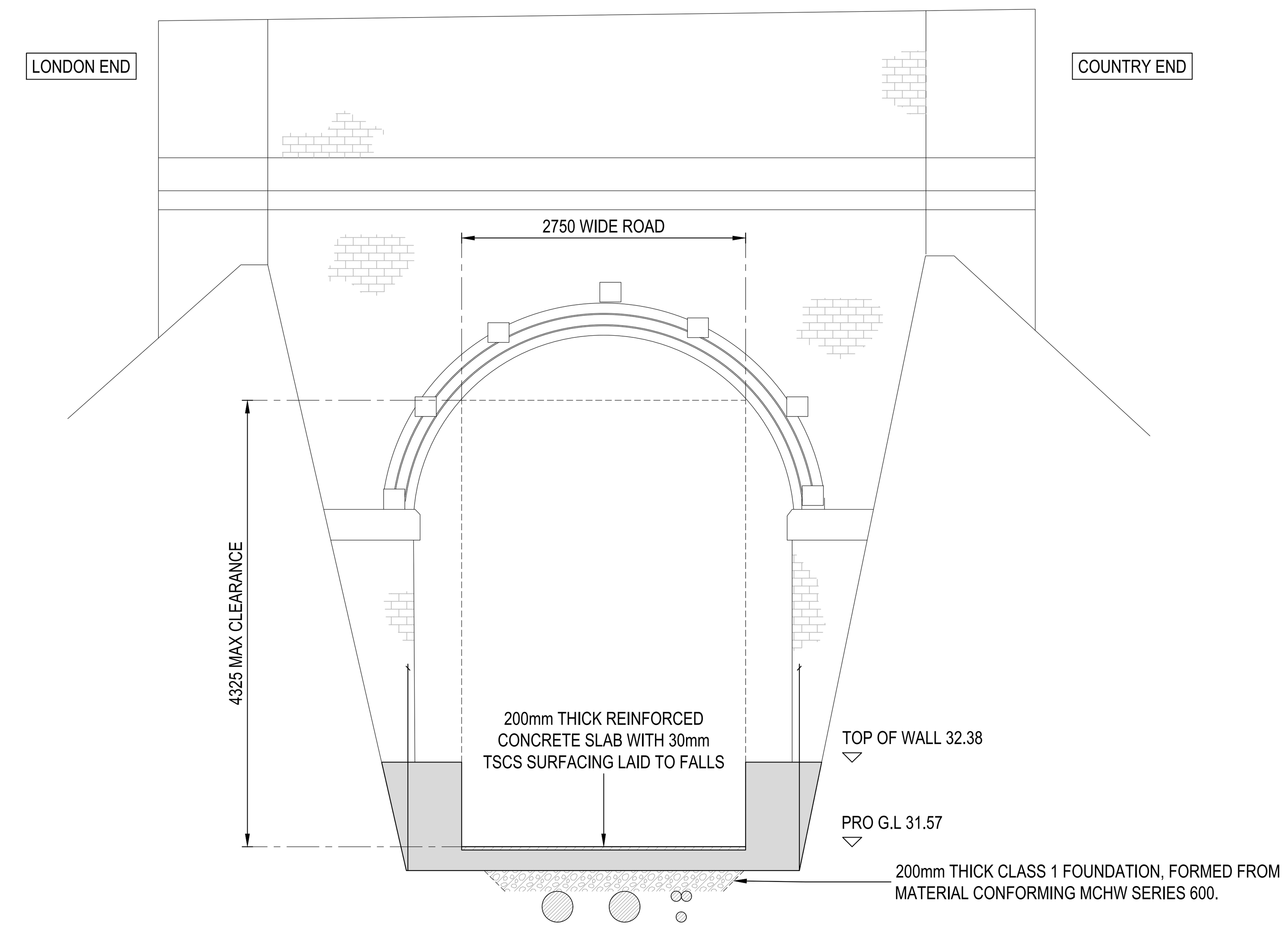
* Click in the last Cell (Column) to add a new row after the selected cell or to delete the selected row

END



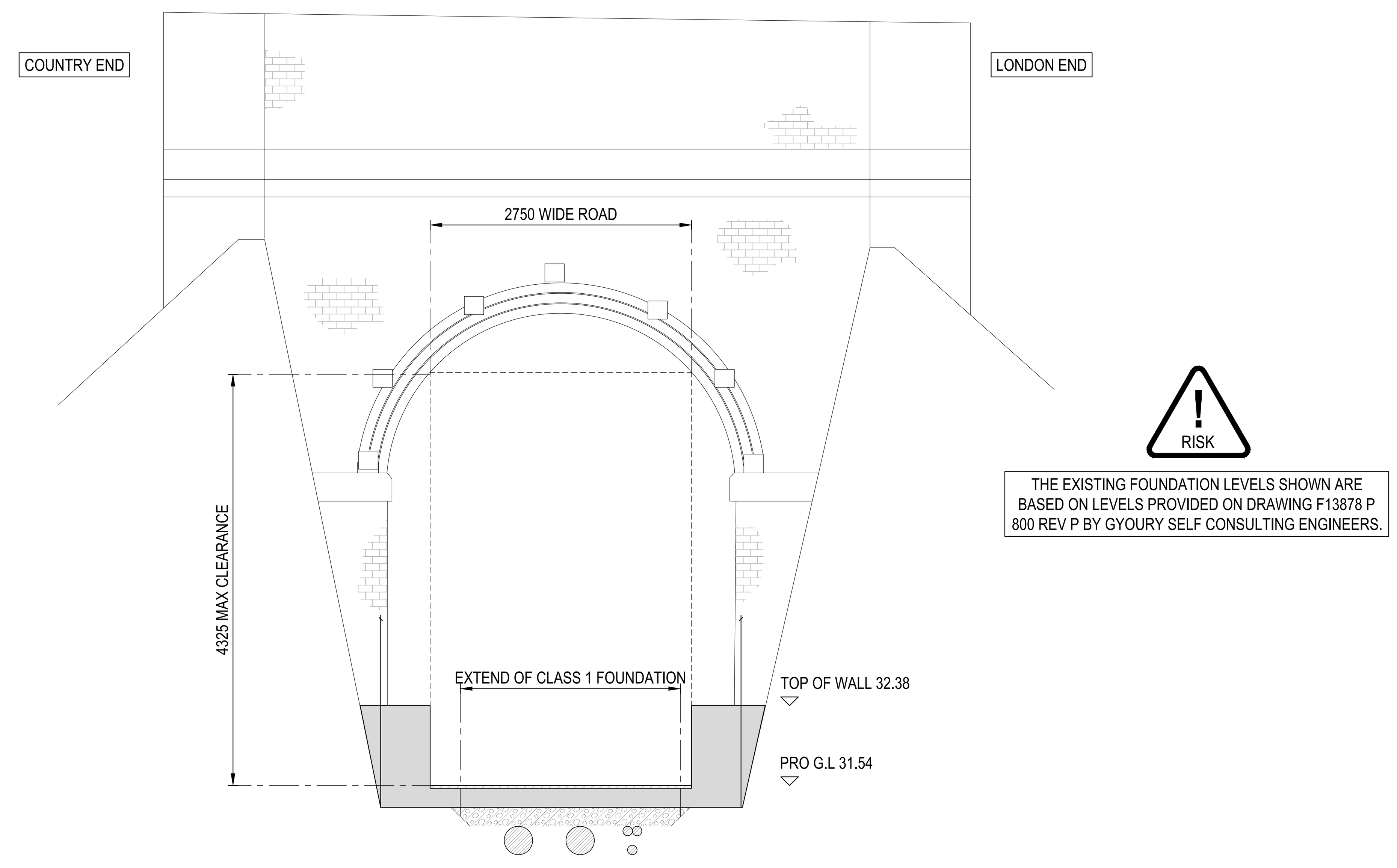
PROPOSED PLAN AT ROAD LEVEL

SCALE 1:75



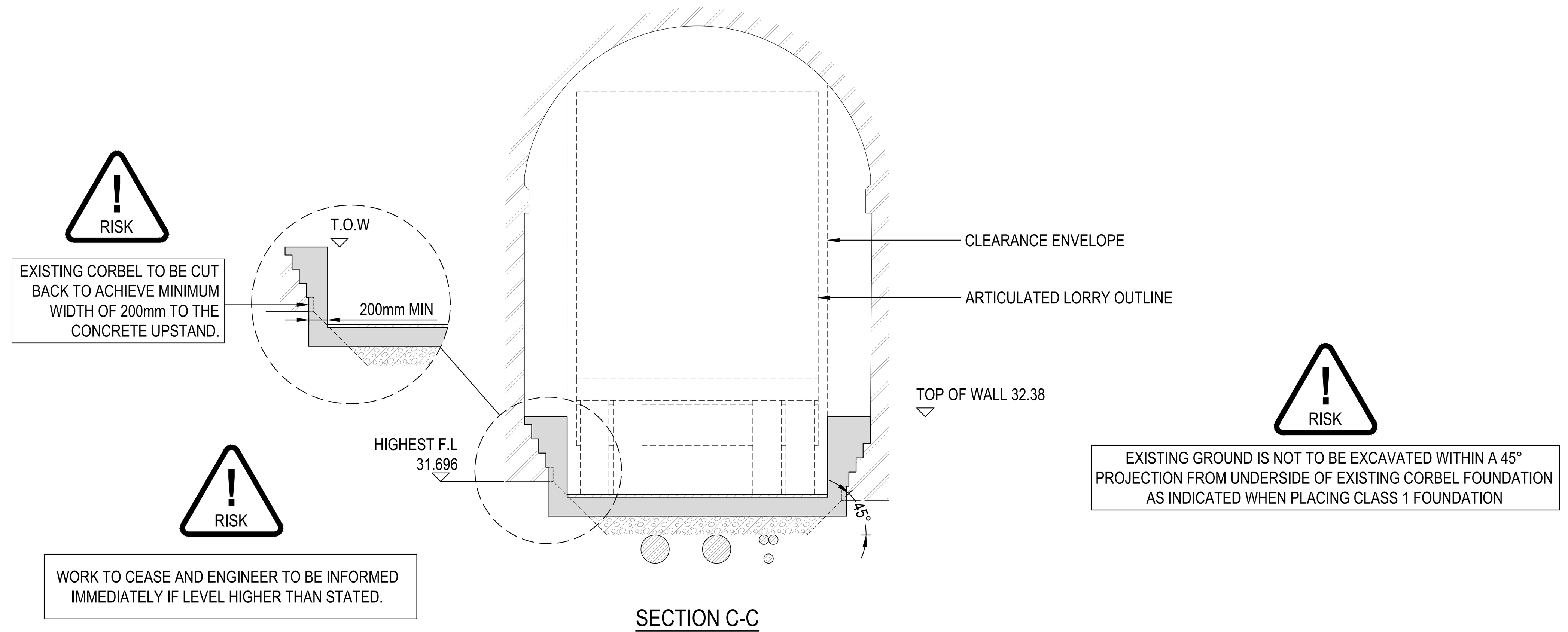
ELEVATION A-A - UPSIDE

SCALE 1:50



ELEVATION B-B - DOWNSIDE

SCALE 1:50



SECTION C-C

SCALE 1:50

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100mm ON ORIGINAL DRAWING

SURVEY

1. THE FOUNDATION LEVELS SHOWN ARE BASED ON LEVELS PROVIDED ON DRAWING F13878 P 800 REV P BY GYOURY SELF CONSULTING ENGINEERS. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE PRIOR TO ANY WORKS BEING PUT IN HAND.

GENERAL

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
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6. ANY DISCREPANCIES IN THE INFORMATION GIVEN ARE TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER AS SOON AS POSSIBLE.
7. ALL MATERIALS USED IN THE WORKS SHALL BE TO EUROPEAN STANDARDS OR OTHER APPLICABLE SPECIFICATIONS.
8. ALL WORK IS TO BE CARRIED OUT TO EUROPEAN EXECUTION STANDARDS AND IN ACCORDANCE WITH GOOD WORKMANSHIP PRACTICE.
9. ALL PROPRIETARY MATERIALS USED IN THE WORKS ARE TO BE USED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS.

REINFORCED CONCRETE

1. CONCRETE MIXES IN ACCORDANCE WITH BS 8500-2 & BS EN 206:
   - SLAB :- C32/40
2. CONCRETE TO BE CURED BY APPROVED METHOD FOR A MINIMUM OF 7 DAYS. FOR GUIDANCE REFER TO 'CONCRETE ADVICE DOCUMENT No. 20' BY 'THE CONCRETE SOCIETY '
3. CARE IS TO BE TAKEN TO PROTECT CONCRETE FROM ADVERSE WEATHER. FOR GUIDANCE REFER TO 'CONCRETE ADVICE DOCUMENT No. 20' BY 'THE CONCRETE SOCIETY '.
4. SAMPLING AND TESTING OF CONCRETE IS TO BE CARRIED OUT IN ACCORDANCE WITH BS EN 12350-1 & 2. FOR GUIDANCE REFER TO 'CONCRETE ADVICE DOCUMENT No. 30' BY 'THE CONCRETE SOCIETY.

FORM 003

REV	AMENDMENT	DRN	CHK	APP	DATE
A	UPDATED SERVICES	KW	BB	MRL	21/07/16
D1	FORM 003 DRAFT ISSUE	KW	SC	MRL	08/03/16

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CROUCH WATERFALL

CLIENT

FROBISHER DEVELOPMENTS LTD

PROJECT TITLE

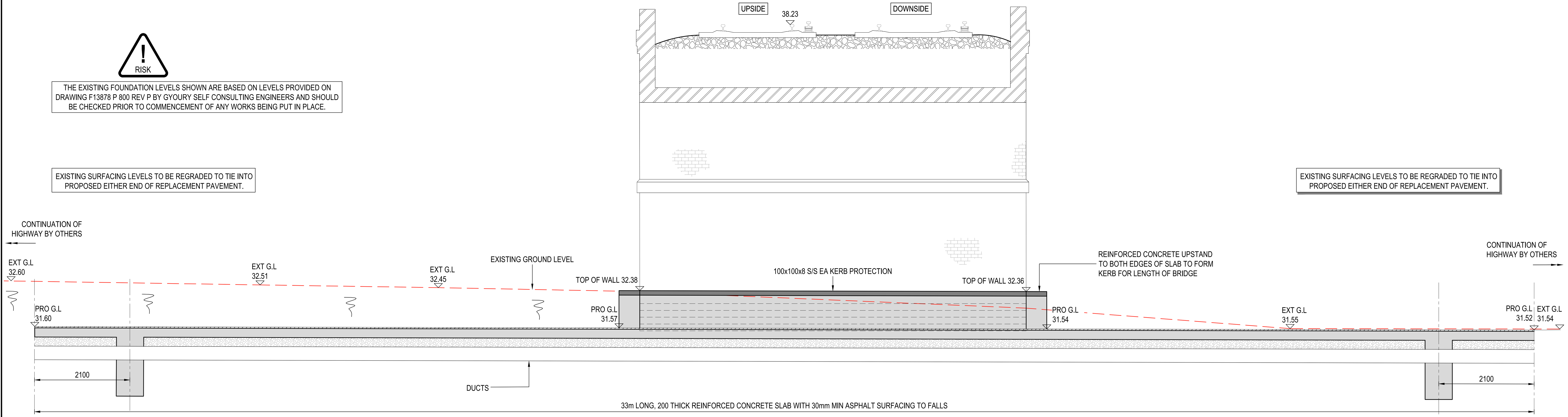
HAYLING FARM BRIDGE
STR:E15/37
ELR: SDP1 MILEAGE: 11.0041

DRAWING TITLE

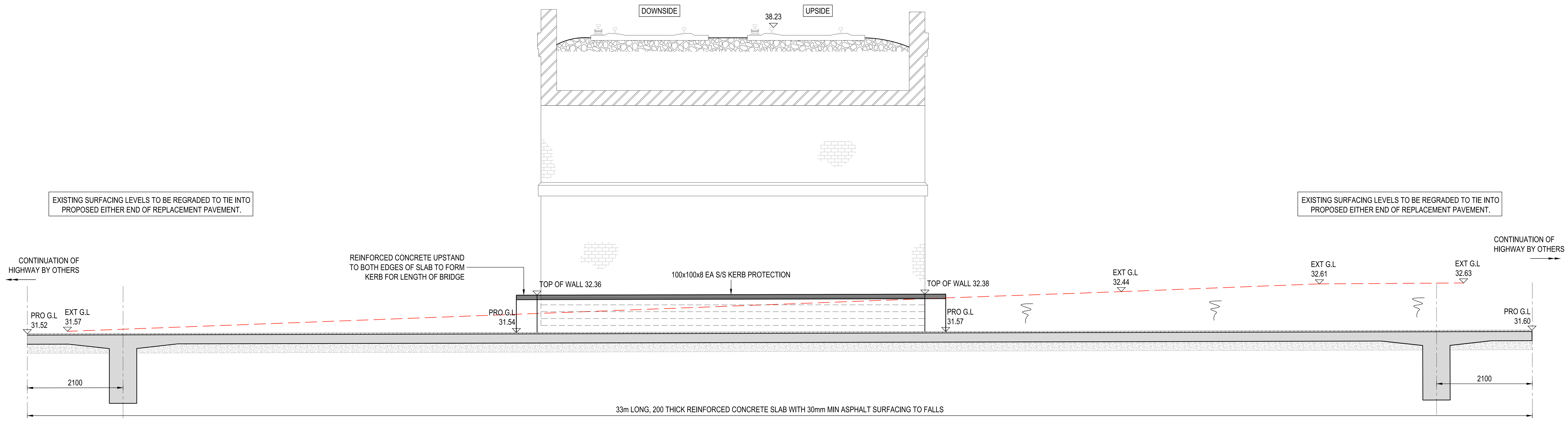
LOW LEVEL BRIDGE PLAN SHOWING PROPOSED ROAD ARRANGEMENT AND SECTIONS

DRAWN	CHK	APP	DATE	SCALE
KW	SC	MRL	JAN '16	AS SHOWN AT A1

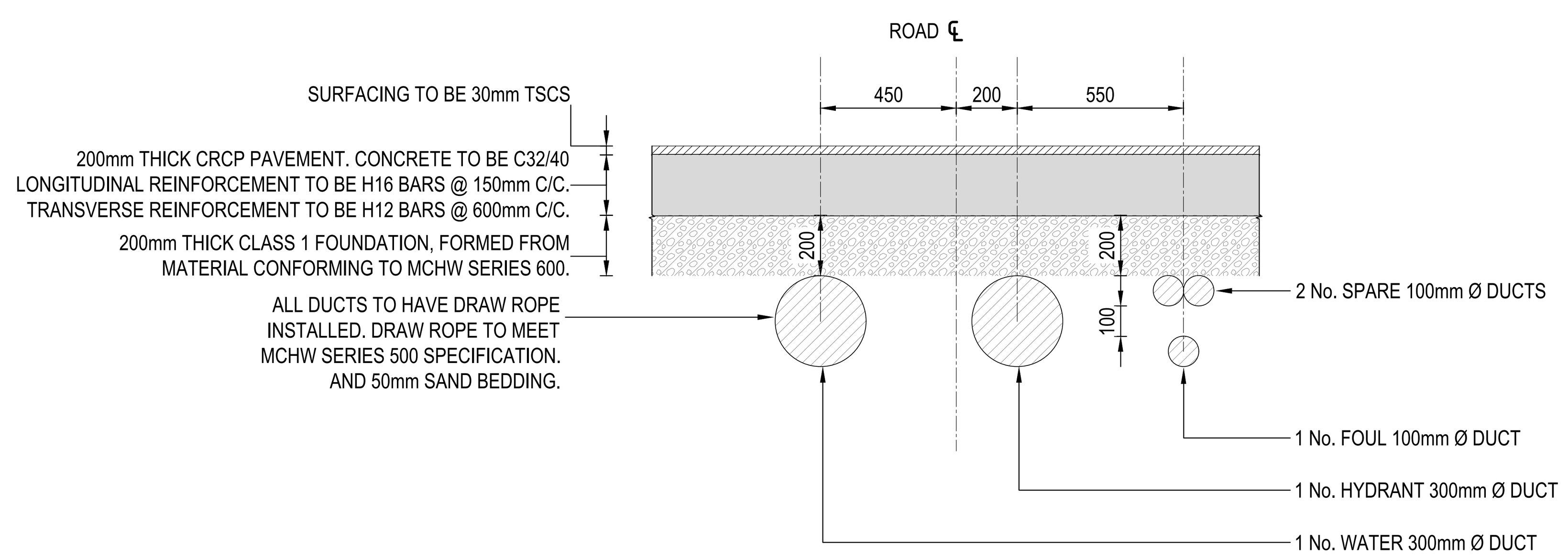
JOB NUMBER	DRAWING NUMBER	REVISION
14-311G	010	A



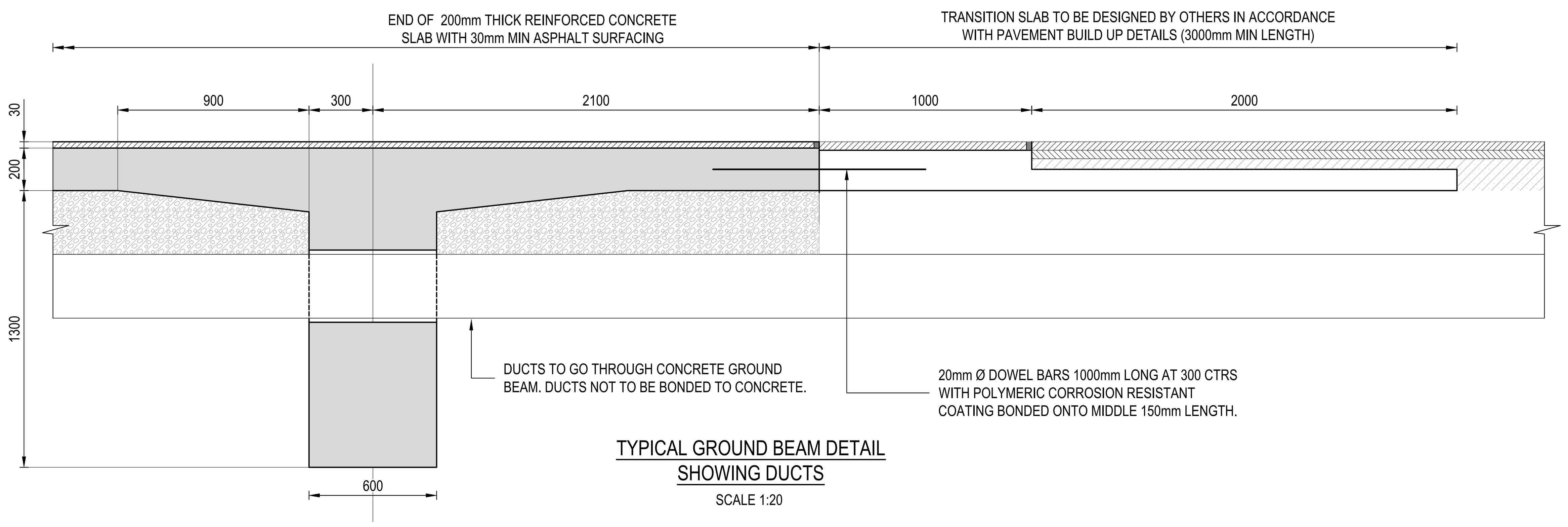
SECTION D-D
SCALE 1:50



SECTION E-E
SCALE 1:50



DUCT DETAIL
SCALE 1:20



TYPICAL GROUND BEAM DETAIL
SHOWING DUCTS
SCALE 1:20

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100mm ON ORIGINAL DRAWING

SURVEY

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FORM 003

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CROUCH WATERFALL

CLIENT
FROBISHER DEVELOPMENTS LTD

PROJECT TITLE
HAYLING FARM BRIDGE
STR:E15/37
ELR: SDP1 MILEAGE: 11.0041

DRAWING TITLE
PROPOSED LONGITUDINAL SECTIONS AND DETAILS

DRAWN	CHK	APP	DATE	SCALE
KW	SC	MRL	JAN '16	AS SHOWN AT A1

JOB NUMBER	DRAWING NUMBER	REVISION
14-311G	011	A

NR/L2/CIV/003/F002: STATEMENT OF DESIGN INTENT		
Issue number	2	Page 1 of 9
Issue date	19th February 2015	

Hayling Farm Underbridge

ELR: SDP1 Mileage: 11.0041 Structure No. 37

Carriageway Lowering and Rigid Pavement Installation

NR/L2/CIV/003/F002

Revision History

Edition	Description	Prepared		Checked		Approved	
		By	Date	By	Date	By	Date
1	First Issue	SC	20/07/16	BB	26/07/16	MRL	27/07/16

Document: 14-311G/F002 Edition 1

NR/L2/CIV/003/F002: STATEMENT OF DESIGN INTENT		
Issue number	2	Page **2** of **9**
Issue date	19th February 2015	

Project title	**Road resurfacing works at E15/37 Little Park Farm Rd, Fareham**		
Project Number	**136555/WR4435**		
CR-T Reference Number		**Statement Ref**	**Rev**
Location	Hayling Farm Underbridge, Little Park Farm Road, Fareham, Hampshire		
ELR	SDP1	Mileage	11.0041
OS grid reference	SU 523 085	Structure Number	E15/37

PART 1: DETAILS

1.1 Scope of Design works

As set out in the Contracts Requirement Technical (CR-T), this submission relates to the Design of the following altered or new asset(s).

Description of Asset	Permanent or Temporary Works
Masonry Arch Bridge over Access Road	Permanent Works – Lowering the carriageway level to accommodate HGV's and associated protective works.

1.2 Proposals for the staging of the Design and Design Check submissions

Design and Design Check submissions for the temporary works to be carried out by Crouch Waterfall.

1.3 Design statement

1.3.1 General

The existing railway bridge over Little Park Farm Road is a brick masonry arch structure supporting two railway tracks between Fareham Junction and Swanwick Station. The abutments, wingwalls, spandrels and parapet are all of brick masonry construction. The Network Rail reference for the structure is bridge number E15/37 on ELR SDP1 at mileage 11m 2ch.

Little Park Farm Road is the only access to a large area of land that is to be developed for commercial use. The current height clearance prevents this development being viable.

The semi-circular arch spans approximately 3.65m, reducing the width of Little Park Farm Road to a single lane beneath the bridge, and has a rise of 1.83m from the springing. The reported headroom clearance above existing ground level is 4.22m at the centre of the arch and 2.25m at the arch springing. Network Rail records indicate the length of the arch to be 8.38m.

Evidence of previous strengthening works in the form of ties bars to the spandrel walls can be seen on the structure. The mortar joints throughout have been recently repointed. The current condition of the bridge is fair with signs of minor spalling to the arch rings and abutments.

A trial pit investigation was undertaken on the 07/10/15 to determine the level of the existing foundations and ascertain if a structural slab or abutment to abutment propping exists in the invert. It was concluded that there is no structural slab, or abutment to abutment propping, in the invert below the structure. A layer of compacted gravel formation, adjacent to the abutments, was located at a depth of approximately 900mm at the Downside and approximately 600mm at the Upside i.e. the observed foundation level of Hayling Farm Bridge. No compacted gravel was located in the centre of the invert which suggests the compacted gravel has been used locally at the mass abutment foundations only. The invert level reduces by approximately 300mm from the Downside to the Upside of the structure, accounting for the formation level differences described above.

It is proposed to lower the existing granular road surface below the structure, and install a new rigid pavement at the lower level, thus increasing the headroom for HGV through traffic.

Traffic management will be installed either side of the bridge to only allow single direction traffic flow at one time. To further minimise any risk of bridge strikes it is proposed to install a physical traffic warning on the bridge approach road, at the start of Little Park Farm Road adjacent to Dewar Close roundabout, in the form of a goal post type frame to warn oversized traffic. Sufficient turning space will be included in the highway design to allow these vehicles to manoeuvre and return.

Concrete upstands at the edge of the invert slab running the length of each abutment are proposed to guide vehicles through the centre line of the road where headroom is a maximum and to provide passive support for the arch foundations.

The proposed concrete slab will be designed as a rigid pavement in accordance with the DMRB HD26/06, pavement design. The surfacing specification is to be in accordance with BS EN 13108, Bituminous mixtures, material, specifications.

Formation Level of the proposed concrete pavement is to be approximately 400mm below the bridge foundation level at the London End. At the Country End the formation will be approximately 150mm below the bridge foundation, due to the foundation being higher in this location. The proposed concrete upstand has been designed to contain any lateral forces arising from the abutment in both the permanent case and during construction.

The road build up will be a 200mm thick concrete pavement and 200mm thick sub base. To minimise any undermining or potential movement the pavement and subbase will be laid in sections and the subbase will be laid so that it is outside a 45° line from the existing bridge foundations. A notional fall will be applied to the road surface to ensure ponding of water does not occur at the structure. The subbase shall be built up of material conforming to Series 600 of the Manual of Contract Documents for Highway Works.

Geotechnical

The ground is formed of a gravelly sand and a CBR of 15% has been taken for the pavement design. A report on the trial pit investigation undertaken has been submitted at F001 stage.

1.4 Standards to be used in the Design

1.4.1 Date of standards freeze

As of this Form 002 submission

1.4.2 List of design standards

BS EN 1991	*Actions on Structures*
BS EN 1991 NA	*UK National Annex*
BS EN 1992	*Design of Concrete Structures*
BS EN 1992 NA	*UK National Annex*
BS EN 1993	*Design of Steel Structures*
BS EN 1993 NA	*UK National Annex*
HD 26/06	*Pavement Design*
IAN 73/06	*Design Guidance for Road Pavement Foundations*
NR/L2/CIV/003/F1991	*Technical Design Requirements for BS EN 1991*
NR/L2/CIV/003/F1992	*Technical Design Requirements for BS EN 1992*
NR/L2/CIV/003/F1993	*Technical Design Requirements for BS EN 1993*
NR/L2/CIV/003	*Technical Approval of Design*

1.5 Derogations and Temporary Non Conformances to standards

None.

1.6 Any other relevant information

None.

1.7 Matters to be considered in the Design

The matters that do not apply to the Works to meet the particular CR-T are to be struck out by the Contractor's Responsible Engineer appointed for the relevant Design phase

1. So far as is reasonably practicable, the Asset affected will be safe in use when used in accordance with its intended purpose
2. Hazards are managed in accordance with requirements of the CDM Regulations. Residual risks are documented in a Risk Register. Risks to both (a) health and safety during construction, maintenance, use, railway operations, and (b) occupational health and safety, are as low as reasonably practicable or better
3. The provisions for examination, maintenance, and eventual renewal/removal are satisfactory.
4. The overall Design concept and appearance of the infrastructure are appropriate for their purpose, location, and site conditions.
5. Where the proposal includes the strengthening, partial renewal, or removal of structures, the stability of the whole structure and all its parts/elements at all stages of the Works are addressed, including the long-term adequacy of the remaining parts/elements of the structure and supporting soil.
6. The effects of the proposals on existing railway infrastructure are adequately considered.
7. Arrangements for liaison and consultation with external bodies (such as Local Authorities, statutory undertakers, the Environment Agency, and landowners) are satisfactory, and the likely effects of the proposals on external organisations are addressed. Required Permissions/Approvals have been obtained to support the proposals.
8. The impact of the proposals on services and service routes is adequately investigated and appropriate mitigation measures have been agreed with the appropriate Authority and incorporated into the Design.
9. ~~The effects on other rail engineering disciplines including track, signalling (including signal sighting), telecommunications, electrification, lighting, and other operational electrical and mechanical equipment have been satisfactorily considered.~~
10. The requirements/recommendations of Railway Group Standards and Network Rail standards have been addressed, and proposed departures from these standards are identified and justified.
11. ~~The requirements of the Building Regulations are met.~~
12. The proposed Design loadings are appropriate, and any non-standard accidental loadings are correctly identified.
13. The requirements of **NR/L2/CIV/003/F1990** to **F1997** have been considered, and the selected options/choices recorded.
14. The proposed Design standards and methods of Design are suitable.

For a Design that requires a Category 3 Design Check:

15. ~~A Geotechnical Design Report (which meets the requirements of **BS EN 1997**) is available. That Report justifies the selection of the Geotechnical Design parameters, and outlines any further work required for implementation.~~
16. ~~The Design complies with the clearance and platform stepping distance requirements.~~
17. Important Design matters not covered by standards are identified.
18. The proposals are appropriately economic and sustainable
19. The proposed works will not compromise the structural robustness of any existing structures.

NR/L2/CIV/003/F002: STATEMENT OF DESIGN INTENT		
Issue number	2	Page **6** of **9**
Issue date	19th February 2015	

20.	All Materials specified in the design of structures are compatible with the intended application and environment. This includes, but is not limited to - fixing metallic structures to masonry with studs bonded with resin, grout or other chemical bonding products. Fixing design are to current standards and guidance. Design and installation comply with manufacturer's requirements, are compatible with substrate and includes appropriate verification testing. Suitable and sufficient investigation, as far as reasonably practical, has been carried out to determine that materials to be used will be compatible.

PART 2: DESIGNER'S SUBMISSION

I confirm that the criteria specified in **NR/L2/CIV/003** have been considered, and

(a) this Statement of Design Intent is submitted on behalf of

Crouch Waterfall, The Dairy, Greenways Studios, Lower Eashing, Godalming, Surrey GU7 2QF

(b) unless identified in **1.2** and **1.5**, (i) the Design will comply with all relevant standards and will be delivered in accordance with the CR-T, and (ii) the deliverables identified within the CR-T will be completed and submitted in support of this submission.

[redacted]	Title **Principal Consultant**
	Date 03.08.2016
To be signed by the Contractor's Responsible Engineer appointed for the relevant Design phase	

NR/L2/CIV/003/F002: STATEMENT OF DESIGN INTENT		
Issue number	2	Page **7** of **9**
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PART 3: CONSTRUCTION ORGANISATION'S ACKNOWLEDGEMENT OF SUBMISSION BY A SUB-CONTRACT DESIGNER

The organisation named in **PART 2** is engaged as a sub-contractor to the organisation stated below. I acknowledge this submission to Network Rail in support of our contract/sub-contract obligation for the provision of this Statement of Design Intent on behalf of Dyer and Butler, Mead House, Station Road, Nursling, Southampton, Hampshire, SO16 0AH*.*

I confirm that, unless stated in **PART 2**, the submission complies with the CR-T.

Signed	Title
Name (print)	Date
To be signed by the Contractor's Responsible Engineer appointed for the Construction phase	

PART 4: PROJECT ENGINEER'S COMMENTS

I have considered the submission and confirm that the information specified in **NR/L2/CIV/003** and the CR-T is included in the submission. My comments on the submission are as follows:

I have reviewed the submission and confirm that, unless stated in **PART 2**, it complies with the Approval in Principle, and the Asset Manager's requirements for this project as set out in the Project Requirements Specification (PRS).

I confirm that the Design is to be checked in accordance with the following Categories.

Description of asset	Design Check Category
Permanent Works – Lowering the carriageway level to accommodate HGV's under masonry arch and associated protective works.	II

Signed	Title
Name (print)	Date
To be signed by the Project Engineer (Building and Civil Engineering)	

NR/L2/CIV/003/F002: STATEMENT OF DESIGN INTENT		
Issue number	2	Page **9** of **9**
Issue date	19th February 2015	

PART 5: ASSET MANAGER'S APPROVAL

I have considered the submission and confirm that the proposed deviations to the PRS are acceptable subject to any comments listed below being addressed within the detailed Design.

Signed	Title
Name (print)	Date
To be signed by the Asset Manager (Structures)	

Signed	Title
Name (print)	Date
To be signed by the Asset Manager (Geotechnical)	

Signed	Title
Name (print)	Date
To be signed by the Asset Manager (Buildings)	

NR/L2/CIV/003/F003: CERTIFICATE OF DESIGN AND CHECK		
Issue number	2	Page **1** of **7**
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Hayling Farm Underbridge

ELR: SDP1 Mileage: 11.0041 Structure No. 37

Carriageway Lowering and Rigid Pavement Installation

NR/L2/CIV/003/F003

Revision History

Edition	Description	Prepared		Checked		Approved	
		By	Date	By	Date	By	Date
1	First Issue	SC	20/07/16	BB	26/07/16	MRL	27/07/16

Document: 14-311G/F003 Edition 1

NETWORK RAIL CIVIL ENGINEERING – WESSEX REGION

NR/L2/CIV/003/F003: CERTIFICATE OF DESIGN AND CHECK		
Issue number	2	Page **2** of **7**
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Project title	**Road resurfacing works at E15/37 Little Park Farm Rd, Fareham**		
Project Number	**136555/WR4435**		
CR-T Reference Number		**Statement Ref**	**Rev**
Location	Hayling Farm Underbridge, Little Park Farm Road, Fareham, Hampshire		
ELR	SDP1	Mileage	11.0041
OS grid reference	SU 523 085	Structure Number	E15/37

PART 1: DETAILS

Design organisation: *Crouch Waterfall, The Dairy, Greenways Studios, Lower Eashing, Godalming, GU7 2QF*

I certify that reasonable professional skill and care have been used with the objective of checking that the Design

(a) complies with the Statement of Design Intent reference 14-311G/F002(1) Hayling Farm

signed by ……………………………………………………..on……………………

(b) complies with the Design standards, codes and methods stated in the Statement of Design Intent, with the following additions

(c) is accurately described by the following drawings, schedules, performance, materials and workmanship specifications, testing and inspection plans and other documents that have been prepared for issue as Approved For Construction pending the completion of **PART 4** of Form 1, and **PART 5** of Form 2, and incorporates feedback from Network Rail on the submission.

Crouch Waterfall Drawing No's:

14-311G – 010	*Low Level Bridge Plan Showing Proposed Road Arrangement and Sections*
14-311G – 011	*Proposed Longitudinal Sections and Details*
14-311G – 012	*Suggested Sequence of Works*
14-311G – 013	*Access Road Height Warning Goal Post Details*

Crouch Waterfall Calculations:

14-311G - Calcs	*Hayling Farm Bridge P1-P21 (1)*

Crouch Waterfall Designer's Risk Assessment:

14-311G-DRA	*Hayling Farm Bridge DRA*

NR/L2/CIV/003/F003: CERTIFICATE OF DESIGN AND CHECK		
Issue number	2	Page **3** of **7**
Issue date	19th February 2015	

(d) the following matters have been considered during the Design

Matters to be considered

1. So far as is reasonably practicable, the Asset affected will be safe in use when used in accordance with its intended purpose.
2. Hazards are managed in accordance with requirements of the CDM Regulations. Residual risks are documented in a Risk Register. Risks to both (a) health and safety during construction, maintenance, use, railway operations, and (b) occupational health and safety, are as low as reasonably practicable or better.
3. The provisions for examination, maintenance, and eventual renewal/removal are satisfactory.
4. The overall Design concept and appearance of the infrastructure are appropriate for its purpose, location, and site conditions.
5. Where the proposal includes the strengthening, partial renewal, or removal of structures, the stability of the whole structure and all its parts/elements at all stages of the Works are addressed, including the long-term adequacy of the remaining parts/elements of the structure and supporting soil.
6. The effects of the proposals on existing railway infrastructure are adequately considered.
7. Arrangements for liaison and consultation with external bodies (such as Local Authorities, statutory undertakers, the Environment Agency, and landowners) are satisfactory, and the likely effects of the proposals on external organisations are addressed. Required Permissions/Approvals have been obtained to support the proposals.
8. The impact of the proposals on services and service routes is adequately investigated and appropriate mitigation measures have been agreed with the appropriate Authority and incorporated into the Design.
9. ~~The effects on other rail engineering disciplines including track, signalling (including signal sighting), telecommunications, electrification, lighting, and other operational electrical and mechanical equipment have been satisfactorily considered.~~
10. The requirements/recommendations of Railway Group Standards and Network Rail standards have been addressed, and proposed departures from these standards are identified and justified.
11. ~~The requirements of the Building Regulations are met.~~
12. The proposed Design loadings are appropriate, and any non-standard accidental loadings are correctly identified.
13. The requirements of **NR/L2/CIV/003/F1990** to **F1997** have been considered, and the selected options/choice recorded.
14. The proposed Design standards and methods of Design are suitable.

For a Design that requires a Category 3 Design Check:

15. ~~A Geotechnical Design Report (which meets the requirements of **BS EN 1997**) is available. That Report justifies the selection of the Geotechnical Design parameters, and outlines any further work required for implementation.~~
16. ~~The Design complies with structure clearance and platform stepping distance requirements.~~
17. Important Design matters not covered by standards are identified.
18. The proposals are appropriately economic, and sustainable.
19. The proposed works will not compromise the structural robustness of any existing structures.

20. All Materials specified in the design of structures are compatible with the intended application and environment.
    This includes, but is not limited to - fixing metallic structures to masonry with studs bonded with resin, grout or other chemical bonding products.
    Fixing design are to current standards and guidance.
    Design and installation comply with manufacturer's requirements, are compatible with substrate and includes appropriate verification testing. Suitable and sufficient investigation, as far as reasonably practical, has been carried out to determine that materials to be used will be compatible.

Sign[redacted]	Title **Principal Consultant**
Nam[redacted]	Date 03.08.2016
To be signed by the Contractor's Responsible Engineer appointed for the relevant Design phase.	

NETWORK RAIL CIVIL ENGINEERING – WESSEX REGION

NR/L2/CIV/003/F003: CERTIFICATE OF DESIGN AND CHECK		
Issue number	2	Page **5** of **7**
Issue date	19th February 2015	

PART 2: CHECK

Checking organisation
Crouch Waterfall, The Dairy, Greenways Studios, Lower Eashing, Godalming, Surrey, GU7 2QF

I certify that reasonable professional skill and care have been used in checking the Design identified in **PART 1** of this Certificate, with the objective of checking that the Design

(a) complies with the Statement of Design Intent reference reference 14-311G/F002(1) Hayling Farm

signed by ……………………………………………… on…………………….

(b) complies with the Design standards, codes and methods stated on the above Statement of Design Intent (including any stated deviations or dispensations), and with any additions stated in **PART 1** of this Certificate: the justification given for these additions is acceptable.

I confirm that the Design was checked as stated below, and that the Design Check has been carried out with the level of independence specified in **NR/L2/CIV/003**.

Description of asset	Design Check Category
Permanent Works – Lowering the carriageway level to accommodate HGV's under masonry arch and associated protective works.	II

Signed	[signature]	Title	ENGINEER
Name (print)	S. CHRISTIAN	Date	JULY 2016
To be signed by the Checker			

NR/L2/CIV/003/F003: CERTIFICATE OF DESIGN AND CHECK		
Issue number	2	Page **6** of **7**
Issue date	19th February 2015	

PART 3: CONSTRUCTION ORGANISATION'S ACKNOWLEDGEMENT OF SUBMISSION BY A SUB-CONTRACT DESIGNER

The Design organisation named in **PART 1** is engaged as a sub-contractor to the organisation stated below. I formally acknowledge the submission of this Certificate to Network Rail in support of our contract/sub-contract obligation for provision of the Design on behalf of **Dyer and Butler, Mead House, Station Road, Nursling, Southampton, Hampshire, SO16 0AH.**

Signed	Title
Name (print)	Date
To be signed by the Contractor's Responsible Engineer appointed for the Construction phase	

NR/L2/CIV/003/F003: CERTIFICATE OF DESIGN AND CHECK		
Issue number	2	Page **7** of **7**
Issue date	19th February 2015	

PART 4: ACCEPTANCE ON BEHALF OF NETWORK RAIL

I accept that, so far as can reasonably be ascertained from the information submitted, the relevant procedures for the Design and Design Check as specified in **NR/L2/CIV/003** have been followed properly.

I have considered the Design Check statement provided in accordance with **5.7** of **NR/L2/CIV/003** and confirm that the stated method of checking was suitable.

I have reviewed the submission and confirm that it fulfils the Project Requirements Specification, and (where required) **NR/L2/CIV/003/F001** and **NR/L2/CIV/003/F002** PART 5.

Signed	Title
Name (print)	Date
To be signed by the Project Engineer (Building and Civil Engineering)	

Designer's Risk Assessment

Designer: Crouch Waterfall	Project: Hayling Farm Bridge – Carriageway Lowering
Job No. 14-311G	Date: July 2016

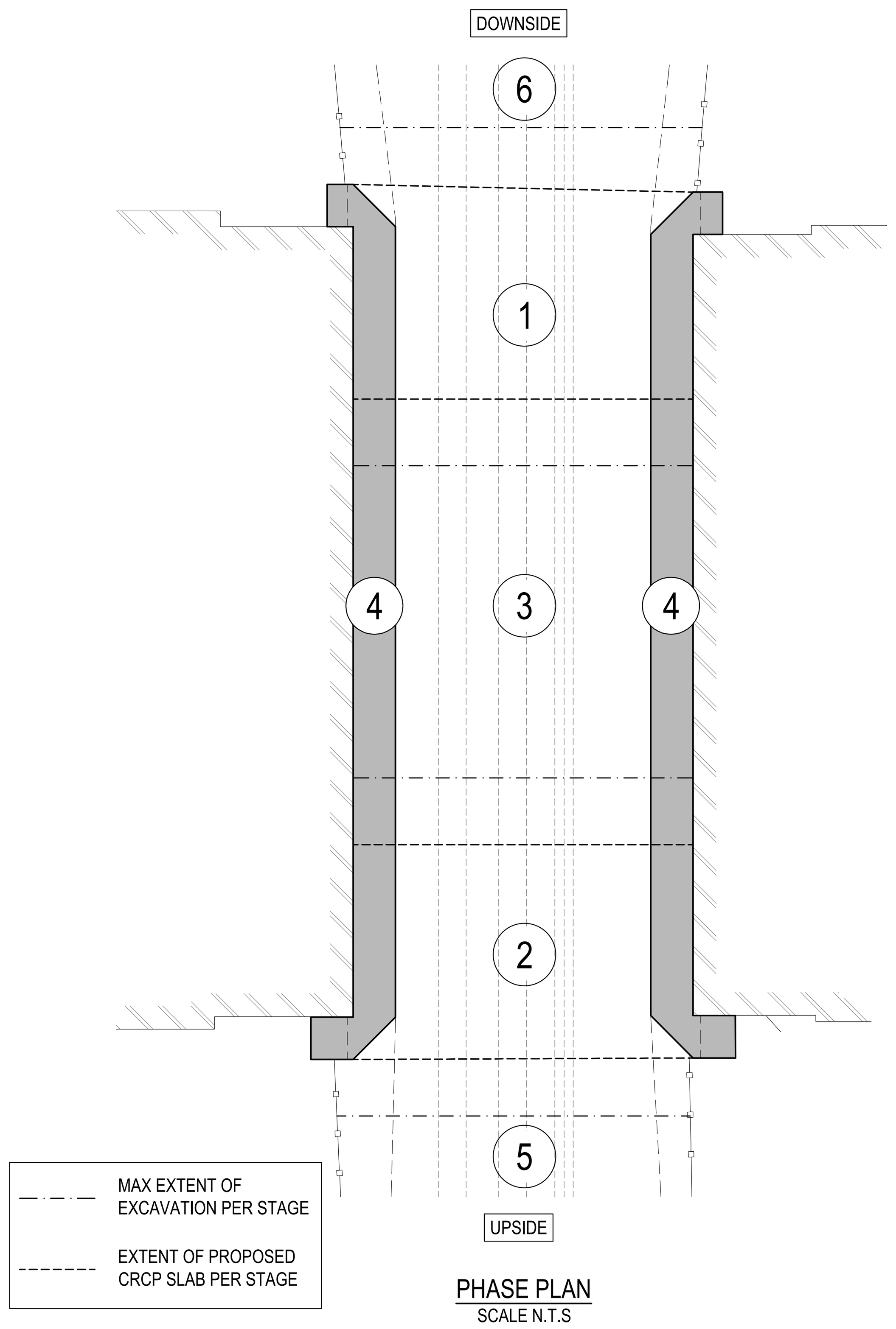
	Activity / Element	Potential Hazards	Population at Risk	Risk Rating L	Risk Rating S	Risk Rating R	Action at Design Stage	Action Taken By	Action Taken Date	Possible Control Options (Contractors)
1	Excavation for new road level	Undermining of existing bridge foundations Contact with services in formation Damage to existing bridge foundations Movement of structure due to removal of passive earth pressure	Workforce Public Railway	L	H	M	• Trial pit investigation undertaken to determine existing foundation level • New carriageway thickness kept to a minimum • Highest foundation point used for setting out proposed slab (worst case) and upstand design • Construction sequence designed to mitigate effect of passive earth pressure removal	N/A – residual risk	July 2016	• Contractor to lay new road formation in discrete sections to avoid large areas of undermined foundation • Contractor to ensure foundation levels are no higher than that shown on structural drawings • Contractor to undertake structure movement monitoring during works with alarming capabilities • Contractor to undertake method statement for construction works that is to include structure movement mitigation measures i.e. provision of emergency propping and details of its implementation should it be required
2	Road in use	Impact with existing bridge Impact with restriction frame	Workforce Public Railway	M	L	M	• Height restriction signs used on approach road and tunnel portals • Reinforced concrete kerb utilised under arch to direct oversized traffic through centre of lane • Height restriction frame designed for approach road	N/A – residual risk	July 2016	• None

Designer: Crouch Waterfall										Project: Hayling Farm Bridge – Carriageway Lowering
Job No. 14-311G										Date: July 2016
	Activity / Element	Potential Hazards	Population at Risk	Risk Rating			Action at Design Stage	Action Taken		Possible Control Options (Contractors)
				L	S	R		By	Date	
3	Future Maintenance / Renewal	Removal of Upstands causing instability	Railway Public	L	M	M	• Risk highlighted to client as future owner	Residual risk	July 2016	• None

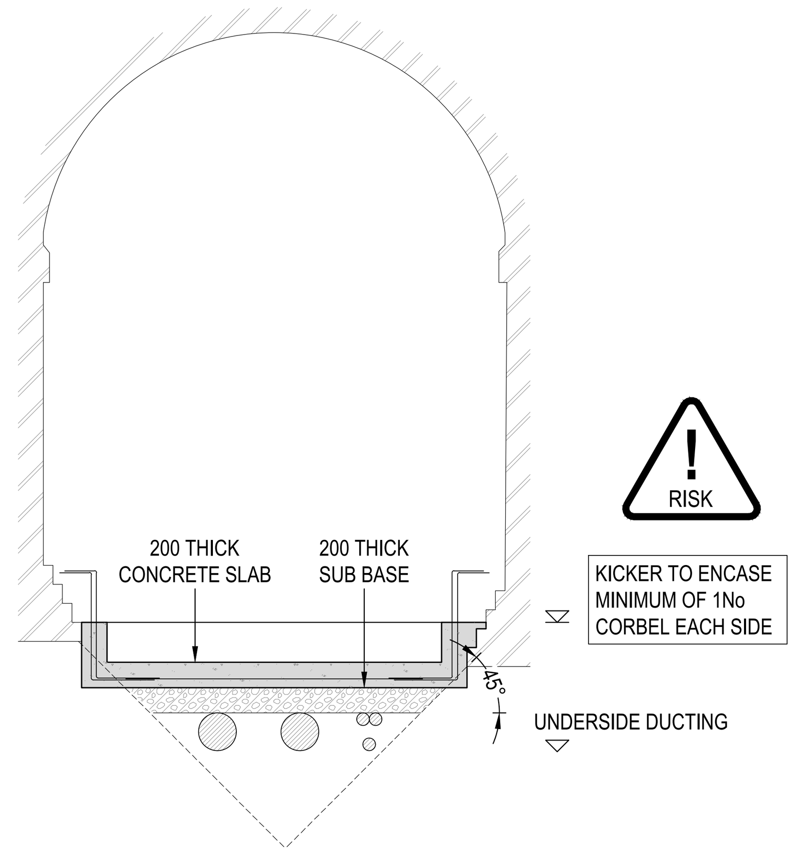
Normal Hazards:
Are hazards inherent in site work such as injury from falling, tripping, lifting materials,
Contact with substances hazardous to health etc. Any competent contractor will address these.

Key:
L = Likelihood (Low, Medium, High) S = Severity (Low, Medium, High) R = Risk (Likelihood x Severity)

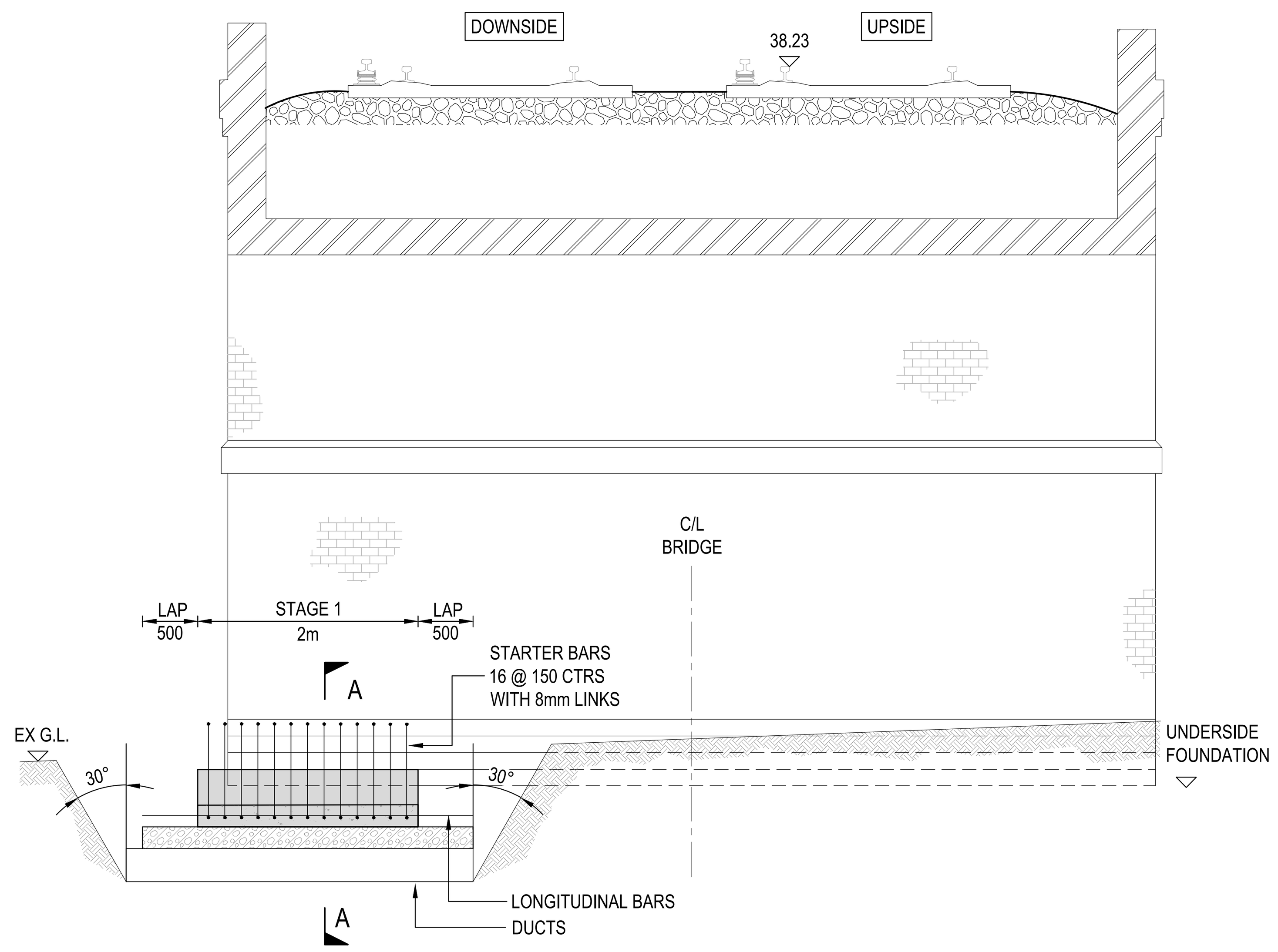
Risk Matrix		Severity		
		L	M	H
Likelihood	L	L	M	M
	M	M	M	H
	H	M	H	H



PHASE PLAN
SCALE N.T.S

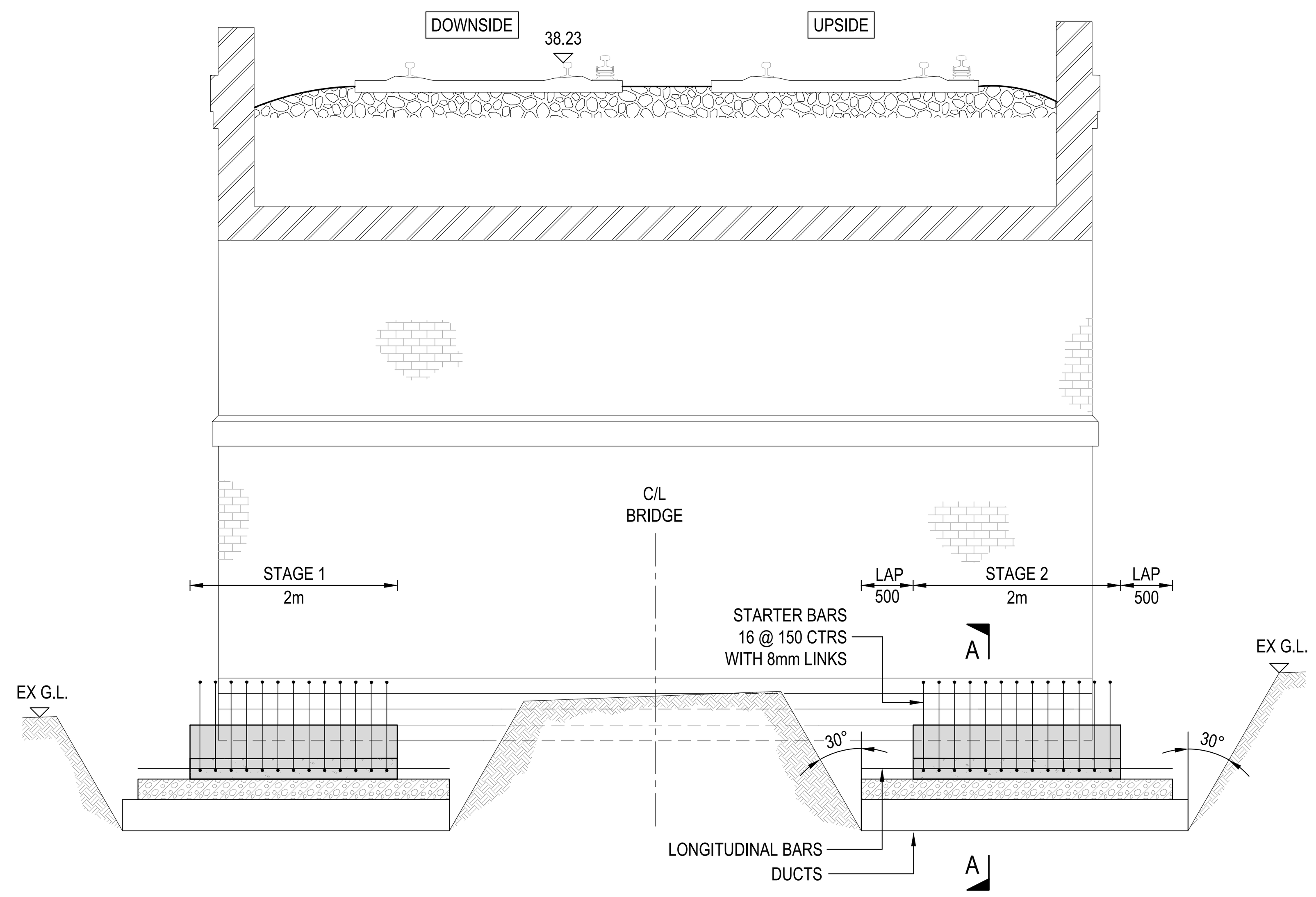


SECTION A-A
SCALE 1:50



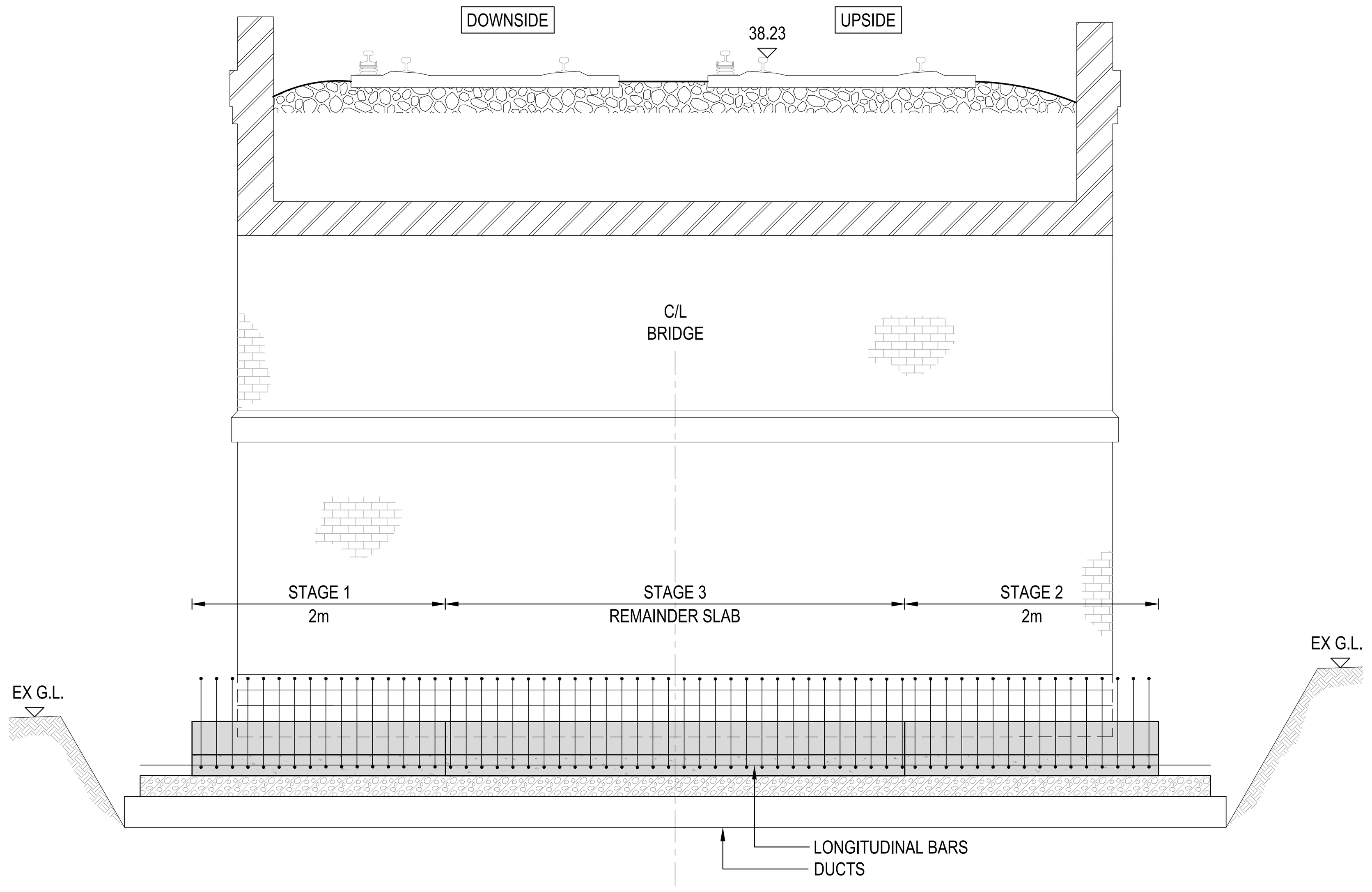
1. WORKING FROM THE DOWNSIDE TOWARDS CENTRE LINE OF THE BRIDGE, EXCAVATE CENTRAL SECTION OF EXISTING ROAD, FOR MAXIMUM 3m LENGTH, ENSURING FOUNDATIONS ARE NOT UNDERMINED (NOTE THE EXCAVATION LIMITS IN RELATION TO THE UNDERSIDE OF THE CORBEL FOUNDATION ON SECTION A-A), EXCAVATE TO LEVEL INDICATED IN DUCT DETAIL ON DWG 011 AND PLACE DUCTS ON SAND BEDDING.
2. PLACE AND COMPACT SUB BASE IN AREA SHOWN ON SECTION A-A.
3. EXCAVATE AREA FOR PROPOSED SLAB FOR 2m LENGTH ADJACENT TO FOUNDATIONS AND PLACE REINFORCEMENT FOR SLAB AND KERB LEAVING LAP PROTRUDING AT EITHER END AND CAST SLAB INCLUDING KICKER, ENCASING A MINIMUM OF 1No. FOUNDATION CORBEL.
4. ALLOW 7 DAYS FOR SLAB TO CURE PRIOR TO MOVING ON TO STAGE 2.

STAGE 1
SCALE 1:50



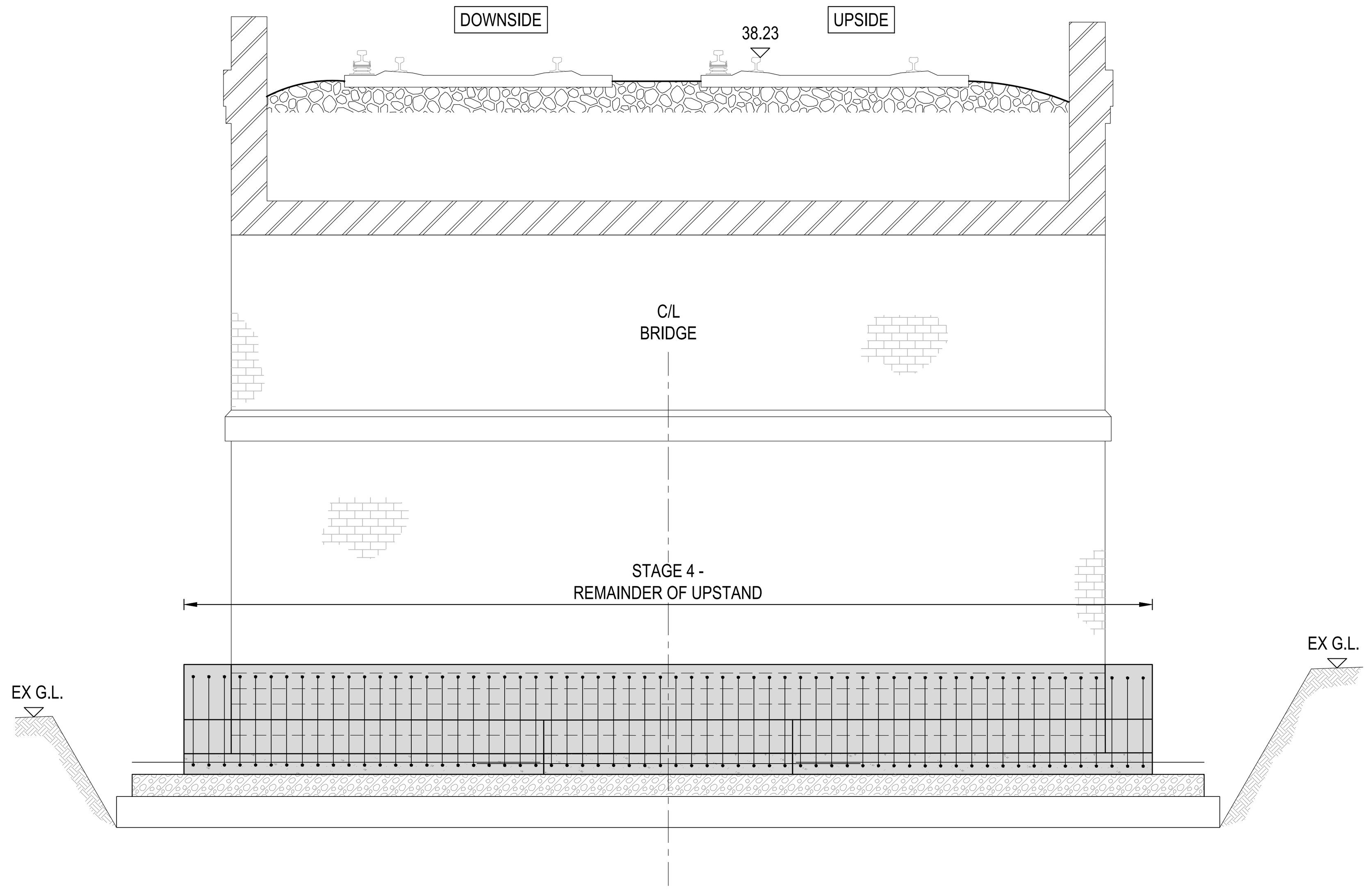
5. WORKING FROM THE UPSIDE TOWARDS CENTRE LINE OF THE BRIDGE, EXCAVATE CENTRAL SECTION OF EXISTING ROAD, FOR MAXIMUM 3m LENGTH, ENSURING FOUNDATIONS ARE NOT UNDERMINED (NOTE THE EXCAVATION LIMITS IN RELATION TO THE UNDERSIDE OF THE CORBEL FOUNDATION ON SECTION A-A), EXCAVATE TO LEVEL INDICATED IN DUCT DETAIL ON DWG 011 AND PLACE DUCTS ON SAND BEDDING.
6. PLACE AND COMPACT SUB BASE IN AREA SHOWN ON SECTION A-A.
7. EXCAVATE AREA FOR PROPOSED SLAB FOR 2m LENGTH ADJACENT TO FOUNDATIONS AND PLACE REINFORCEMENT FOR SLAB AND KERB LEAVING LAP PROTRUDING AT EITHER END AND CAST SLAB INCLUDING KICKER, ENCASING A MINIMUM OF 1No. FOUNDATION CORBEL.
8. ALLOW 7 DAYS FOR SLAB TO CURE PRIOR TO MOVING ON TO STAGE 3.

STAGE 2
SCALE 1:50



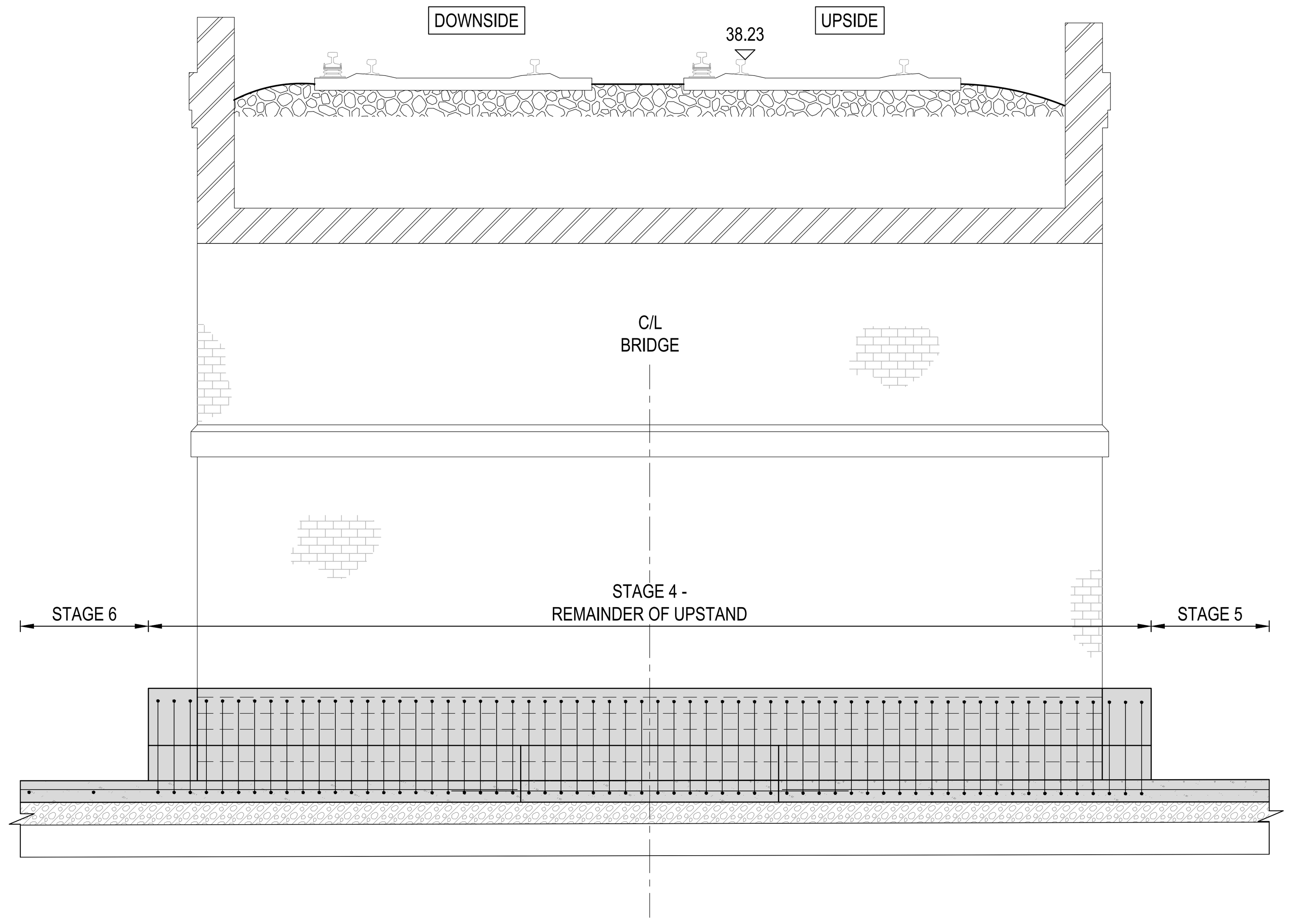
9. WORKING AT THE CENTRE LINE OF THE BRIDGE, EXCAVATE CENTRAL SECTION OF EXISTING ROAD, BETWEEN DOWNSIDE AND UPSIDE SLABS, ENSURING FOUNDATIONS ARE NOT UNDERMINED (NOTE THE EXCAVATION LIMITS IN RELATION TO THE UNDERSIDE OF THE CORBEL FOUNDATION ON SECTION A-A), EXCAVATE TO LEVEL INDICATED IN DUCT DETAIL ON DWG 011 AND PLACE DUCTS ON SAND BEDDING CONNECTING TO PRE-LAID DUCTS AT DOWNSIDE AND UPSIDE.
10. PLACE AND COMPACT SUB BASE IN AREA SHOWN ON SECTION A-A.
11. EXCAVATE AREA FOR PROPOSED SLAB ADJACENT TO FOUNDATIONS BETWEEN DOWNSIDE AND UPSIDE SLAB SECTIONS AND PLACE REINFORCEMENT FOR SLAB AND KERB LAPPING INTO PROTRUDING BARS AT EITHER END AND CAST SLAB INCLUDING KICKER, ENCASING A MINIMUM OF 1No. FOUNDATION CORBEL.

STAGE 3
SCALE 1:50



12. FIX REMAINING UPSTAND REINFORCEMENT.
13. CAST REMINDER OF UPSTAND AND AFFIX STAINLESS STEEL ANGLE.

STAGE 4
SCALE 1:50



14. EXCAVATE DOWNSIDE ROAD, PLACE DUCTS, PLACE AND COMPACT SUB BASE, PLACE REINFORCEMENT AND CAST ROAD CONSTRUCTION TO EXTENT INDICATED ON DRAWING 14-311G-011.
15. EXCAVATE UPSIDE ROAD, PLACE DUCTS, PLACE AND COMPACT SUB BASE, PLACE REINFORCEMENT AND CAST ROAD CONSTRUCTION TO EXTENT INDICATED ON DRAWING 14-311G-011.
16. GRADE IN GROUND TO EITHER END OF PAVEMENT AND CAST TRANSITION SLAB TO EACH END OF CRCP SLAB AND LAY SURFACING OVER.

STAGE 5-6
SCALE 1:50

REV	AMENDMENT	DRN	CHK	APP	DATE
A	UPDATED SERVICES	KW	BB	MRL	21/07/16
D1	FORM 003 DRAFT ISSUE	KW	SC	MRL	08/03/16

FORM 003

20 0 20 40 60 80
100mm ON ORIGINAL DRAWING

THE DAIRY, GREENWAYS STUDIOS
LOWER EASHING
GODALMING
SURREY
GU7 2QF

Tel 01483 425 314
office@crouchwaterfall.co.uk

CROUCH WATERFALL

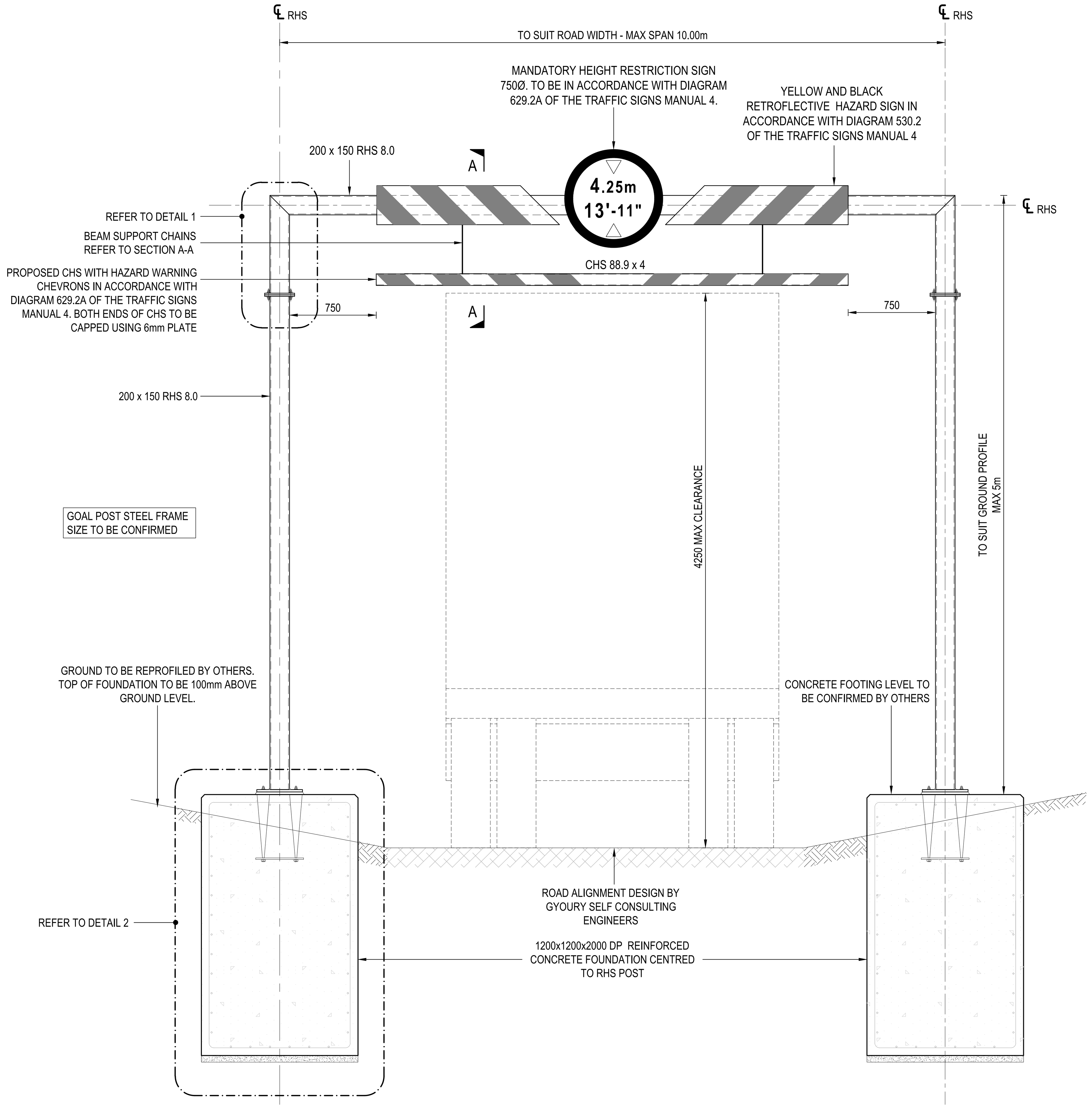
CLIENT
FROBISHER DEVELOPMENTS LTD

PROJECT TITLE
HAYLING FARM BRIDGE
STR:E15/37
ELR: SDP1 MILEAGE: 11.0041

DRAWING TITLE
SUGGESTED SEQUENCE OF WORKS

DRAWN	CHK	APP	DATE	SCALE
KW	SC	MRL	JAN `16	AS SHOWN AT A1

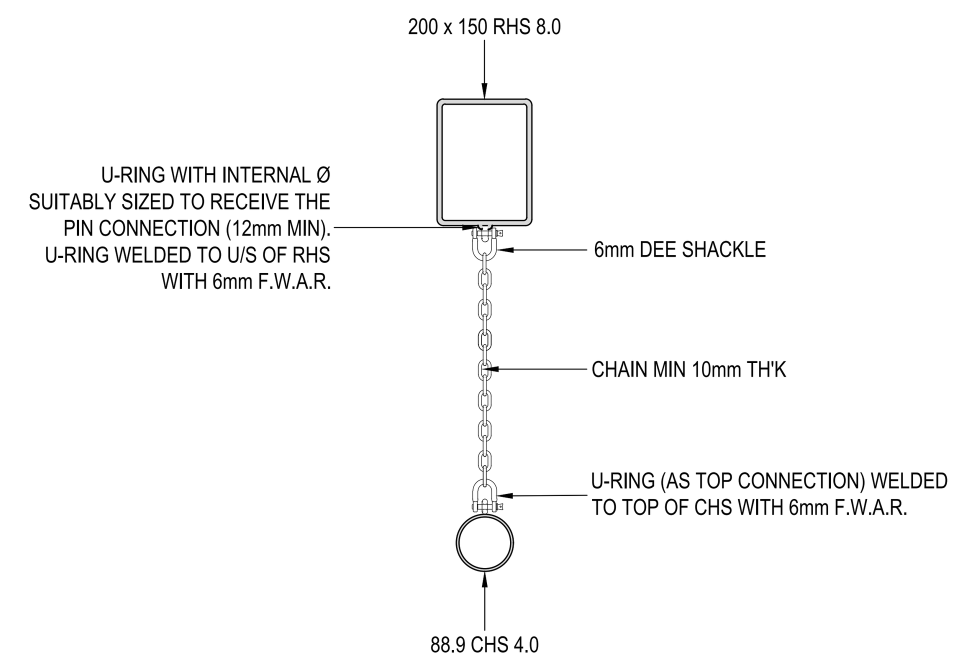
JOB NUMBER	DRAWING NUMBER	REVISION
14-311G	012	A



ELEVATION ON GOAL POST HEIGHT WARNING BARRIER

SCALE 1:25

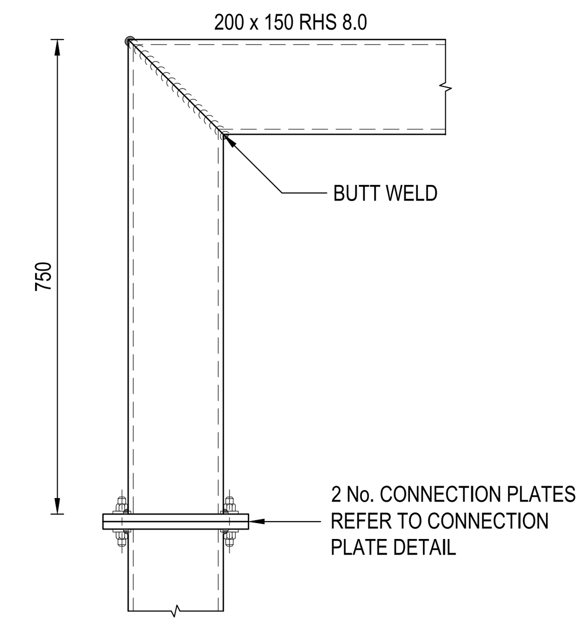
FOR GOAL POST LOCATION REFER TO GYOURY SELF CONSULTING ENGINEERS DESIGN DRAWINGS



SECTION A-A

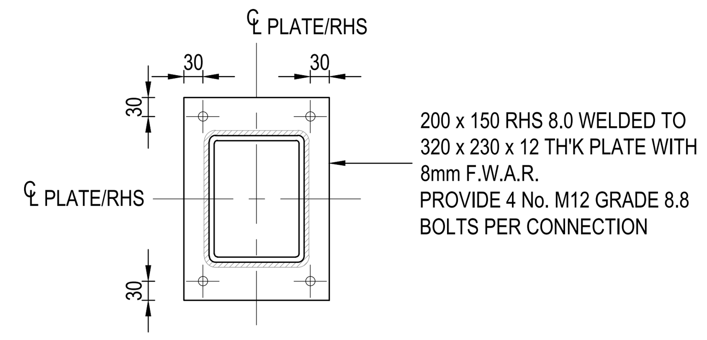
SCALE 1:10

HAZARD WARNING SIGNS OMITTED FOR CLARITY



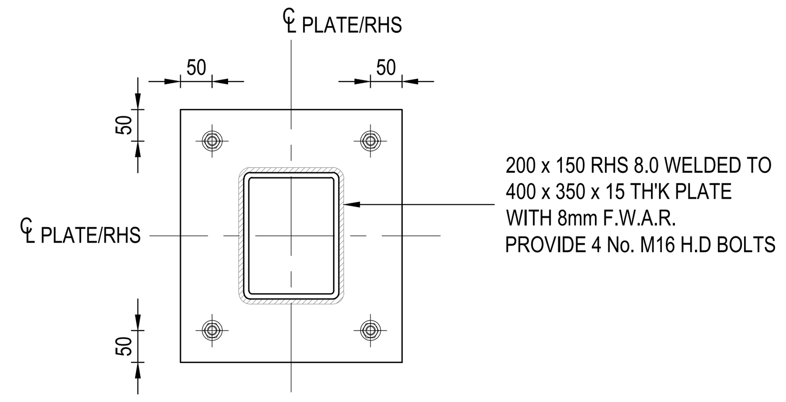
DETAIL '1'

SCALE 1:10



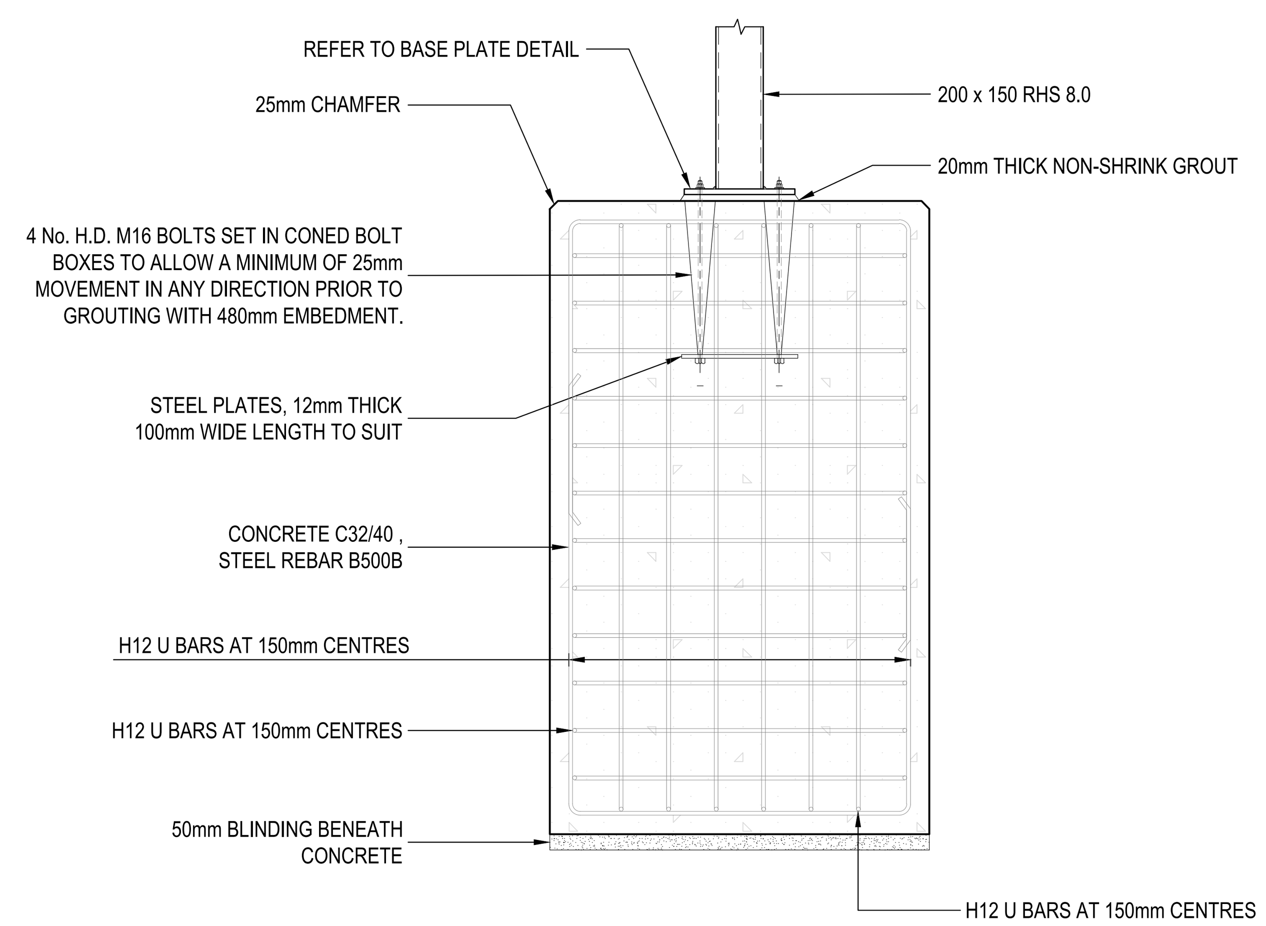
CONNECTION PLATE DETAIL

SCALE 1:10



PLAN ON BASE PLATE

SCALE 1:10



DETAIL '2'

SCALE 1:20

20 0 20 40 60 80

100mm ON ORIGINAL DRAWING

GENERAL

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS NOTED OTHERWISE.
3. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE PRIOR TO ANY WORKS BEING PUT IN HAND.
4. IF DURING THE WORKS THE CONTRACTOR IS CONCERNED ABOUT THE STABILITY OF THE EXISTING STRUCTURE HE SHOULD CEASE ACTIVITIES AND CONTACT THE ENGINEER.
5. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER CONTRACT DRAWINGS AND RELEVANT STRUCTURAL SPECIFICATIONS.
6. ANY DISCREPANCIES BETWEEN THE INFORMATION GIVEN ARE TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER AS SOON AS POSSIBLE.
7. ALL MATERIALS USED IN THE WORKS SHALL BE TO EUROPEAN STANDARDS OR OTHER APPLICABLE SPECIFICATIONS.
8. ALL WORK IS TO BE CARRIED OUT TO EURO CODES OF PRACTICE AND IN ACCORDANCE WITH GOOD WORKMANSHIP PRACTICE.
9. ALL PROPRIETARY MATERIALS USED IN THE WORKS ARE TO BE USED IN COMPLETE ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS.
10. INSTALLED SIGNS MUST MEET TRAFFIC SIGNS MANUAL REQUIREMENTS AND BE CONFIRMED WITH THE HIGHWAY AUTHORITY.

STEELWORK

1. THE WHOLE OF THE STRUCTURAL STEELWORK IS TO COMPLY WITH THE RELEVANT CLAUSES OF BS EN 1993-1, AND THE NATIONAL STRUCTURAL STEELWORK SPECIFICATION (5th EDITION)
2. ALL MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 2 OF THE NSSS (5th EDITION)
3. STEELWORK GRADES ARE TO BE AS FOLLOWS:
   - CHS, RHS & ANGLE SECTIONS, PLATES TO BE MIN GRADE S275 J2 TO EUROCODE.
   - DEE SHACKLE AND U-RING TO BE GRADE S235.
4. WORKMANSHIP SHALL BE IN ACCORDANCE WITH SECTIONS 4 TO 9 OF THE NSSS (5th EDITION) UNLESS NOTED OTHERWISE.
5. ALL BUTT WELDS TO BE FULL PENETRATION BUTT WELDS PERFORMED DURING FABRICATION.
6. SURFACE PROTECTION TO EXPOSED STEELWORK TO BE N1 WITH MINIMUM 25 YEAR SERVICE LIFE IN ACCORDANCE WITH NETWORK RAIL STANDARD NR/GN/CIV/002 'USE OF PROTECTIVE TREATMENTS AND SEALANTS' AND NR/L3/CIV/039.
7. FINISH COAT COLOUR 14-C-40 'MOSS GREEN' TO BS 4800.
8. STORAGE AND HANDLING PROCEDURES SHALL ENSURE THAT DAMAGE TO PROTECTIVE SYSTEMS IS MINIMISED. ANY DAMAGE IS TO BE MADE GOOD ON SITE (INACCESSIBLE AREAS PRIOR TO ERECTION).

BOLTS

1. ALL BOLTS ARE TO BE BLACK BOLTS GRADE 8.8 (min) TO BS 4190.
2. HOLE SIZES AND SPACINGS ARE TO BE IN ACCORDANCE WITH BS EN 1993-1-8 & N.A. TO BS EN 1993-1-8.

REINFORCED CONCRETE

1. CONCRETE MIXES IN ACCORDANCE WITH BS 8500-2 & BS EN 206:
   - FOUNDATION :- C32/40
   - BLINDING :- C8/10
2. BLINDING TO BE 50mm THICK BENEATH ALL AREAS OF CONCRETE

FORM 003

REV	AMENDMENT	DRN	CHK	APP	DATE
A	FROM 003 ISSUE	KW	BB	MRL	27/07/16
D1	FORM 003 DRAFT ISSUE	KW	MW	MRL	08/03/16

THE DAIRY, GREENWAYS STUDIOS
LOWER EASHING
GODALMING
SURREY
GU7 2QF

Tel 01483 425 314
office@crouchwaterfall.co.uk

CROUCH WATERFALL

CLIENT

FROBISHER DEVELOPMENTS LTD

PROJECT TITLE

HAYLING FARM BRIDGE
STR:E15/37
ELR: SDP1 MILEAGE: 11.0041

DRAWING TITLE

ACCESS ROAD HEIGHT WARNING GOAL POST DETAILS

DRAWN	CHK	APP	DATE	SCALE
KW	MW	MRL	JAN '16	AS SHOWN AT A1

JOB NUMBER	DRAWING NUMBER	REVISION
14-311G	013	A

Segensworth North West, Little Park Farm Road, Fareham, PO15 5SW

Type: General industrial and/or storage & distribution uses with ancillary offices.

Description: Segensworth North West is a predominantly Greenfield site which is 6.64 ha in size. It has been allocated for a mix of employment uses, specifically general industrial and/or storage & distribution uses with ancillary offices.

Location: The Segensworth North West site straddles the boundaries of both Fareham Borough and Winchester District Councils, with the majority of the site within Fareham. The site is located to the south of the M27 and to the west of Junction 9, which is midway between the two core cities of Southampton and Portsmouth. It is also alongside and to the north of the main Cardiff/Brighton Railway Line, with Swanwick station located immediately west of the site. Access to the site is from the A27 Segensworth Roundabout via the Segensworth West employment area, Little Park Farm Road and a restricted width railway bridge.

Plot Size and Estimated Employment Floor Space Provision:

Table 7: Breakdown of available development land and estimated floor space (CIA) at Little Park Farm

Plot Size (ha)	Plot size (Acres)	Floor Space (sq. ft.)	Floor Space (sq. m)
6.64[12]	16.41	120,556	11,200[13]

Planning Status: Segensworth North West is allocated for employment uses Fareham Borough Council's Development Sites and Policies Plan, which was adopted on 8th June 2015. The allocation is for employment space (B1, B2, B8) of approximately 11,200 sq. m. The site as a whole does not yet have planning permission, however, consent has been granted for a commercial storage use on part of the site.

Travel Times:

Swanwick is the nearest train station, located within a 5 minute drive from the site. There is the potential for walking access from Swanick Station to be created as part of the development. This would enable immediate pedestrian access to Little Park Farm from Swanick Station

Strategic Connection	Drive Time
Portsmouth	15 minutes
M27/A3(M) Interchange	14 minutes
Southampton	20 minutes
Central London	1 hour 36 minutes

Airport	Drive Time
Southampton Airport	13 minutes
London Heathrow	1 hour 10 minutes
London Gatwick	1 hour 25 minutes

Rail Station	Travel Time
Swanwick – Southampton	17 minutes
Swanwick – Portsmouth & Southsea	31 minutes
Swanwick – London Waterloo	1 hour 50 minutes

12 5.3 ha is of the site is situated within Fareham Borough Council, with the remaining 1.34 ha situated within Winchester Borough Council.
13 This is based on a plot ratio of 20%. The site capacity at a 30% plot ratio would be 16,800 sq. m.

Development Considerations:

- **The primary access to the site is currently a single track lane (Little Park Farm Road) accessed from Segensworth West Industrial Estate to the south, which passes underneath the railway line (in control of Network Rail) on entry to the site.**
- **Interim road improvements are programmed which will allow access for HGV traffic up to 3.87m high and 2.55m wide. Preliminary engineering design plans are available on request.**
- **Proposals for substantial road and bridge access reconstruction are planned which will enable all unescorted sizes of HGV traffic to access the site. Engineering designs for these works, including cycleway and pedestrian access are available on request.**
- **A number of oak trees on the periphery of the site are protected by a Tree Preservation Order. These will be incorporated into the actual landscaping scheme for the site and is allowed for within the net developable site areas listed.**
- **It is anticipated that primary development platforms would offer approximately 5.119 ha net.**
- **An initial ecological survey supports the concept of development.**
- **Consideration of the noise impact and air pollution resulting from the site's proximity to the M27 must be considered in any development proposals.**

Key Contacts:

Landowner: [redacted]m

Marketing Agents: [redacted]

[redacted]

[redacted] [redacted]

[redacted]

Figure 26: Red line plan of Segensworth North West.

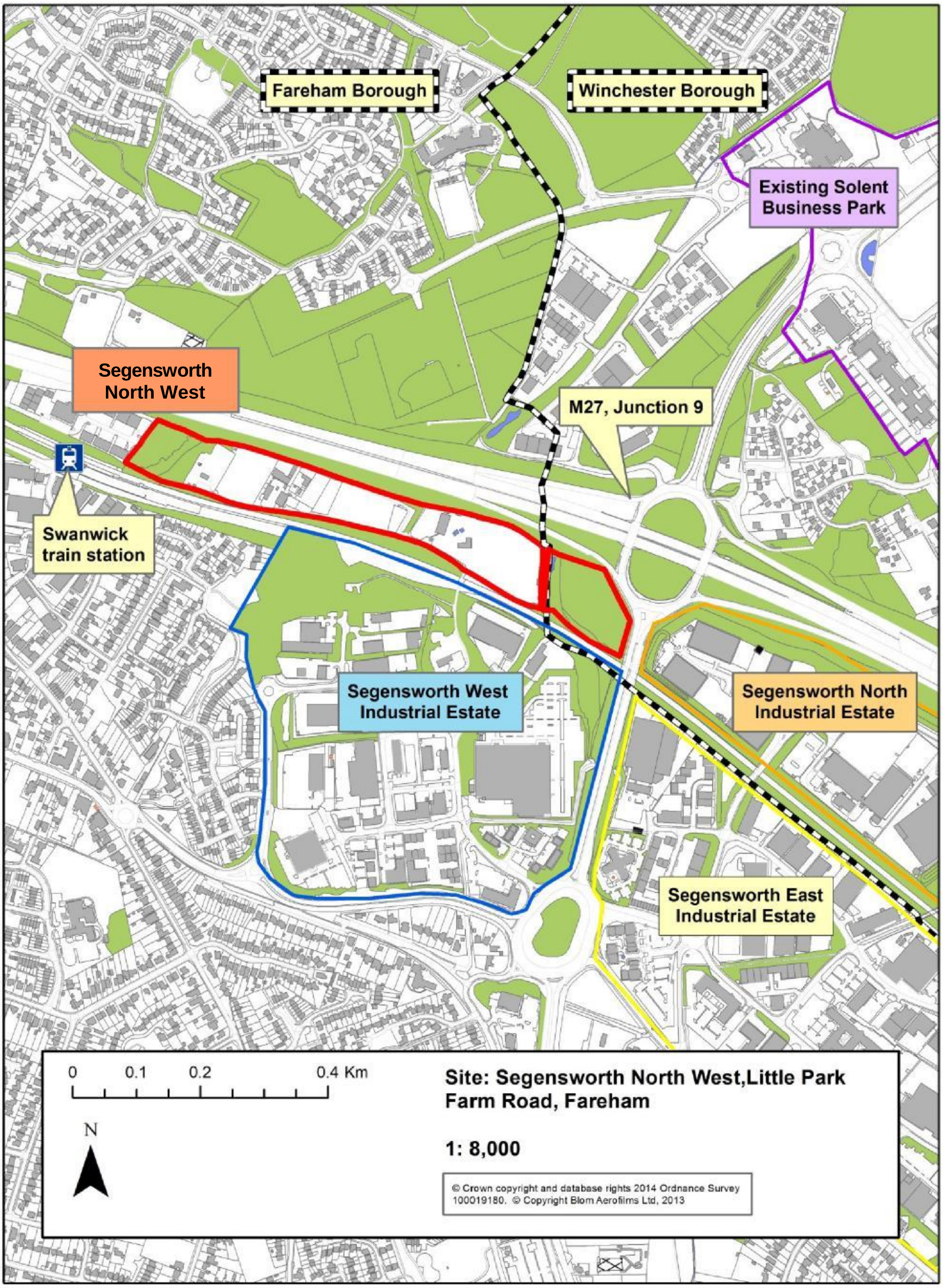


Figure 27: Aerial photograph of Segensworth North West.

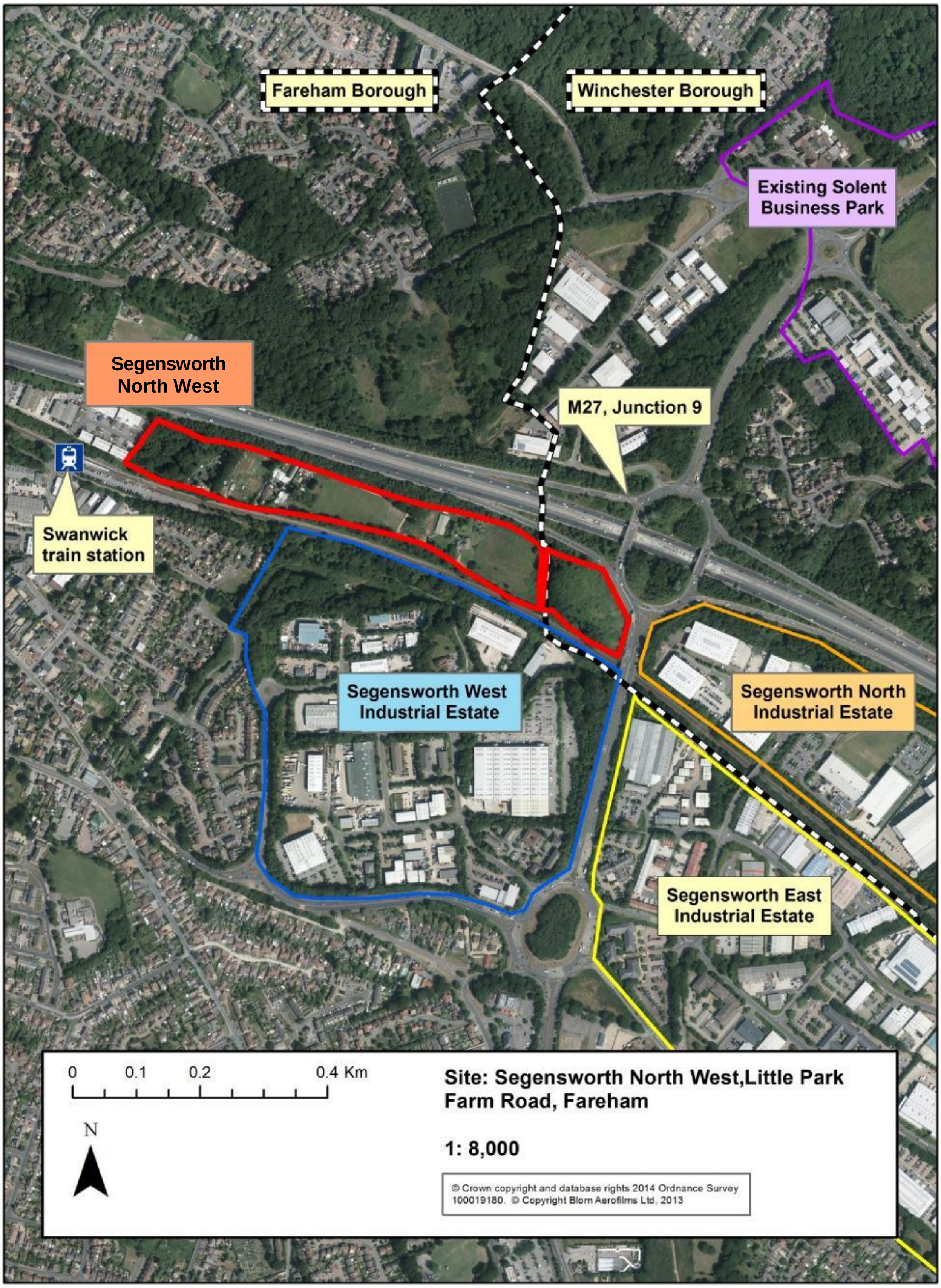


Figure 28: Development considerations map of Segensworth North West.

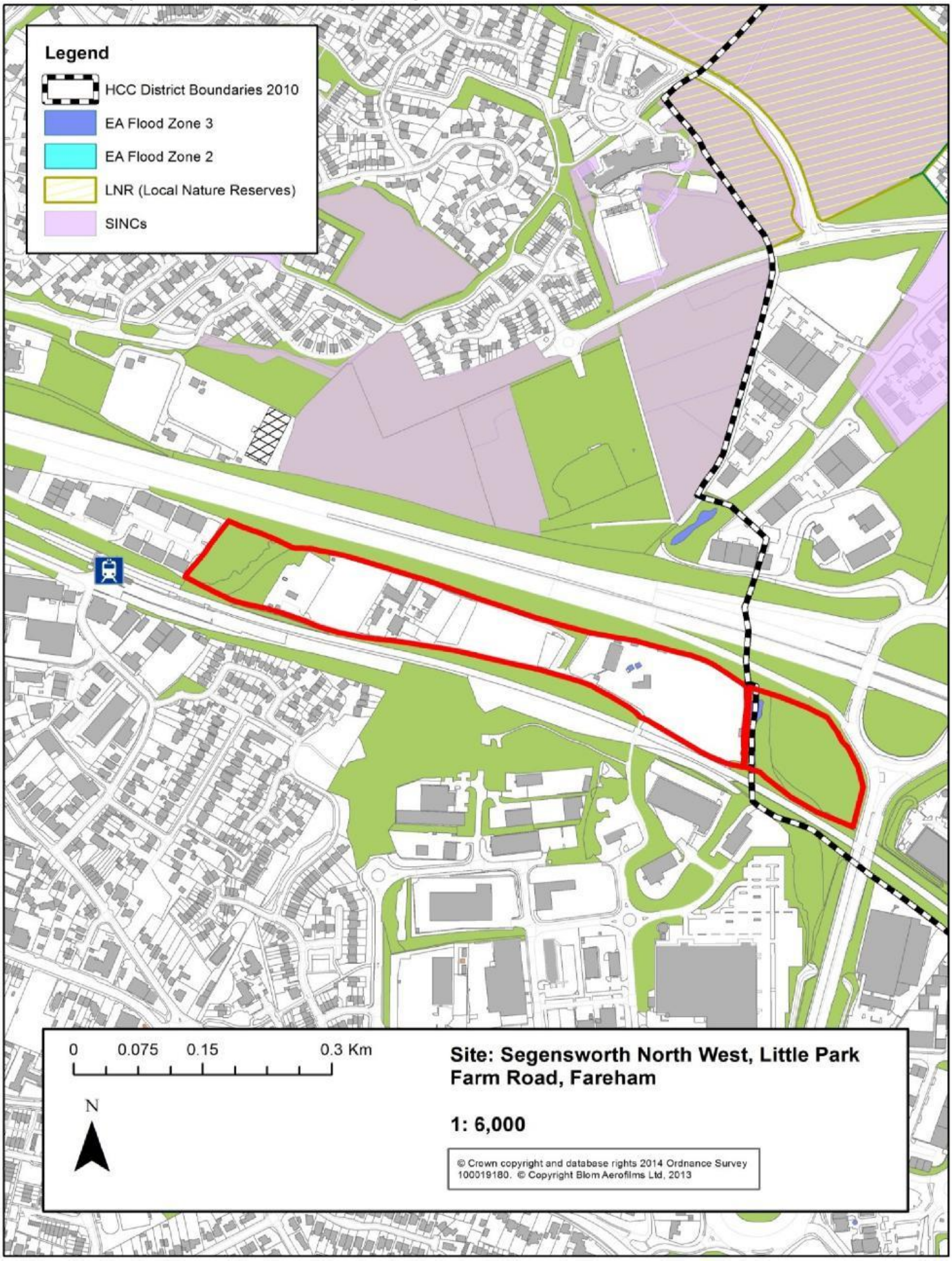


Figure 29: Site layout plan for Segensworth North West.

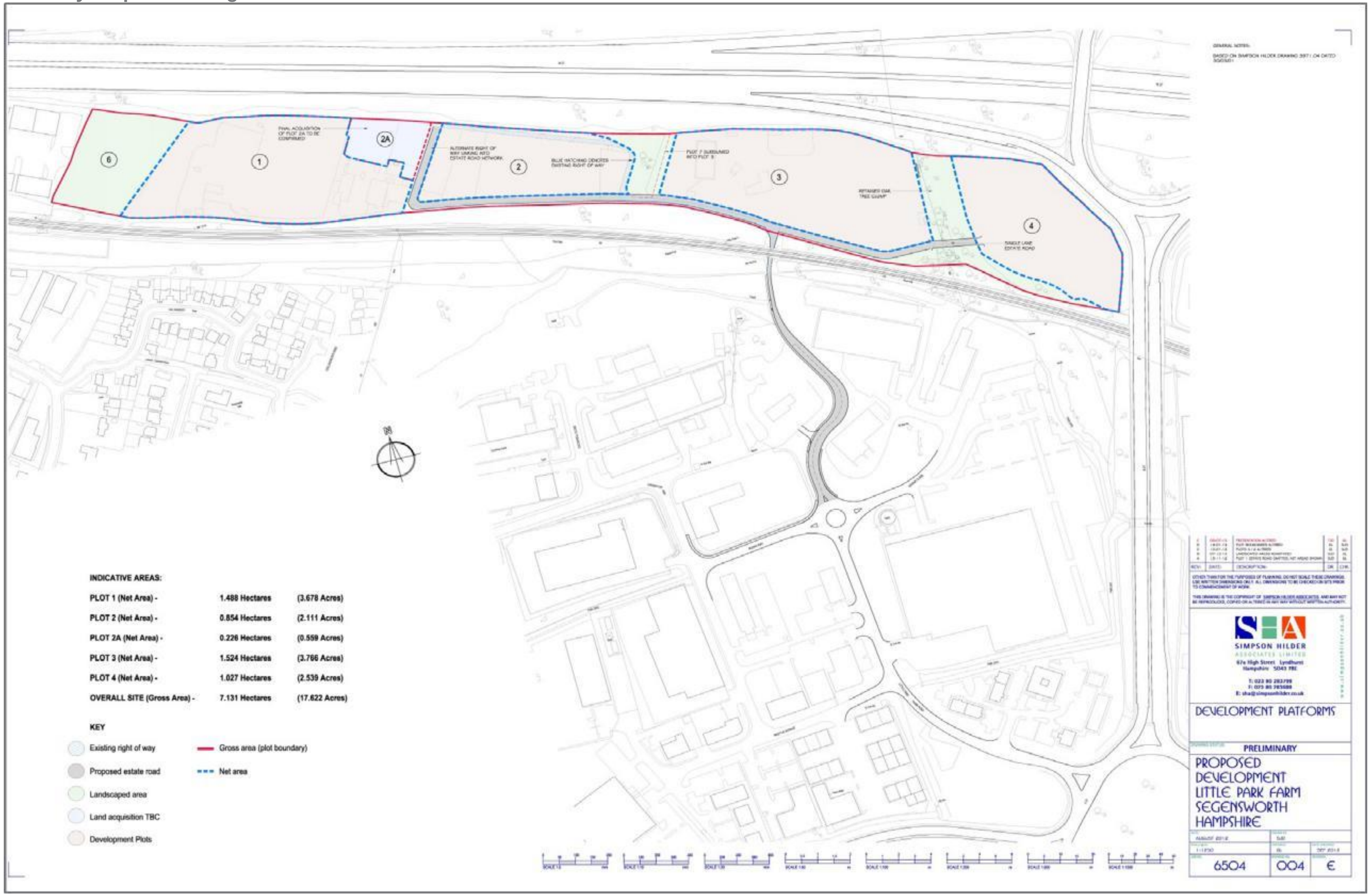


Figure 30: Aerial photograph of Segensworth North West.

Source: Image courtesy of Frobisher Developments Limited

DESIGN CRITERIA

CROUCH WATERFALL

Project Title	Job No	By	Date
HAYLING FARM BRIDGE	14-311G	MW	MAR-16
	Checked	**Date**	**Page of**
	SC	MAR. 16	0 20

References

Element of Works

STABILITY OF ARCH AND RESISTANCE OF CONCRETE UPSTAND

DESIGN OF GOALPOST STRUCTURE
DESIGN OF ROADWAY

Intended Use

Loading

60 kN/m² Live load to Arch

Wind Loading / Impact Loading to Goalpost

Standards Adopted

BSEN 1990
BSEN 1992
BS EN 1997
BS EN 1993
IAN 73/06
HD 26/06

Materials

Concrete

Steel

Design Assumptions / Limitations

Computer Analysis Reference

N/A

Design Check Level

Internal A

Internal B

External C

Checked [redacted]

Date :-

Approve[redacted]

Date :-

Checked Externally By :-

Company:-

Date :-

Comments

None

Results

CALCULATION SHEET		CROUCH WATERFALL

Project Title	Job No	By	Date
HAYLING FARM BRIDGE	14-311G	MW	MAR '16
	Checked: SC	Date: Apr '16	Page 1 of 20

References | Results

CONTENTS

THE WORKS AT HAYLING FARM CONSISTS OF THREE ELEMENTS:

1. Upstand shear - check

Force V estimation

$\gamma_g := 20 \frac{kN}{m^3}$ $\quad \phi := 30\ deg$ — Ground parametrs

$K_{a.g} := \left(\tan\left(45\ deg - \frac{\phi}{2}\right)\right)^2 = 0.333$

$R := 2\ m$ — Tunnel size and depths

$h_1 := 1.2\ m$

$h_2 := h_1 + R = 3.2\ m$

$h_3 := h_2 + 3.25\ m = 6.45\ m$

$L := 1\ m$ — Considered tunnel length

$H_{arch} := 0.5516 \cdot (h_1 \cdot \gamma_g) \cdot R = 26.477 \frac{kN}{m}$ — Strut force

$e_{ah2} := h_2 \cdot \gamma_g \cdot K_{a.g} \cdot 1\ m = 21.333 \frac{kN}{m}$ — Active ground pressure

$e_{ah2} = H_{arch}$ — Estimated point of balance for strut force with active ground pressure

$e_{ah2} := h_2 \cdot \gamma_g \cdot K_{a.g} = 21.333\ kPa$ — Ground pressure

$e_{ah3} := h_3 \cdot \gamma_g \cdot K_{a.g} = 43\ kPa$ — Ground pressure

$L_T := 8.5\ m$ — Tunnel length

$q_V := 2 \cdot 150 \frac{kN}{m} \cdot \frac{1}{L_T} = 35.294 \frac{kN}{m^2}$ — Distributed train load

$e_{qV} := q_V \cdot K_{a.g} = 11.765\ kPa$ — Horizontal pressure from surface load

Shear force at bottom surface of brick foundation

$$V_{Ek.shear} := \frac{2}{3} \cdot (e_{ah3}) \cdot (h_3 - h_2) + \frac{1}{2} \cdot (e_{qV}) \cdot (h_3 - h_2) = 112.284 \frac{kN}{m}$$

$\gamma_G = 1.35 \qquad \gamma_Q = 1.5$

$$V_{Ed.shear} := \frac{2}{3} \cdot (e_{ah3} \cdot \gamma_G) \cdot (h_3 - h_2) + \frac{1}{2} \cdot (e_{qV} \cdot \gamma_Q) \cdot (h_3 - h_2) = 154.451 \frac{kN}{m}$$

$\mu := 0.5$ — Friction coefficient

$F_\mu := \mu \cdot 6.7\ m^2 \cdot \gamma_g = 67 \frac{kN}{m}$ — Friction force below the foundation

Upstand shear

$V_{Ed.shear} := V_{Ed.shear} \cdot L = 154.451\ kN$ $\qquad f_{ck} = 30\ MPa$ C30/37

$h := 150\ mm$

$b := 1\ m$

$d_{eff} := h - 56\ mm = 94\ mm$ Effective depth

$b_w := b = 1\ m$ Control perimeter - conservatively perimeter of set of washer plates

$$k := min\left(1 + \sqrt{\frac{200 \cdot mm}{d_{eff}}}, 2\right) = 2$$

$\sigma_{cp} := 0\ MPa$ Compression stress

NA 1992-1-2

6.4.4 (1) $k_1 := 0.1$

$$v_{min} := 0.035 \cdot k^{\frac{3}{2}} \cdot \left(\frac{f_{ck}}{MPa}\right)^{\frac{1}{2}} \cdot MPa = 0.542\ MPa$$ Minimum shear concrete capacity

$$V_{Rd.c.min} := (v_{min} + k_1 \cdot \sigma_{cp}) \cdot b_w \cdot d_{eff} = 50.968\ kN$$ Shear resistance of the section

$F_\mu := F_\mu \cdot L = 67\ kN$ Friction force per 1m

$V_{Ed.shear} < F_\mu + V_{Rd.c.min} = 0$ $\qquad \frac{V_{Ed.shear}}{F_\mu + V_{Rd.c.min}} = 1.309$ FAIL ~~PASS~~

Conservatively the calculation doesn't take into the consideration additional benef of shear enhancement.

$$C_{Rd.c} := \frac{0.18}{\gamma_C} = 0.12$$

$\phi_g := 12\ mm$ Rebar size

$$A_{sl} := 3 \cdot \frac{1000}{100} \cdot \pi \cdot \left(\frac{\phi_g}{2}\right)^2 = 3392.92\ mm^2$$ Longitudinal reinforcement

$$\rho_L := \frac{A_{sl}}{b \cdot h} = 0.023$$

$$V_{Rd.C} := \max\left(C_{Rd.c} \cdot k \cdot \left(100 \cdot \rho_L \cdot \frac{f_{ck}}{MPa}\right)^{\frac{1}{3}} \cdot MPa \cdot b_w \cdot d_{eff}, (v_{min} + k_1 \cdot \sigma_{cp}) \cdot b_w \cdot d_{eff}\right) = 92.02\ kN$$

$F_\mu + V_{Rd.C} > V_{Ed.shear} = 1$ $\qquad \frac{V_{Ed.shear}}{F_\mu + V_{Rd.C}} = 0.971$ **PASS**

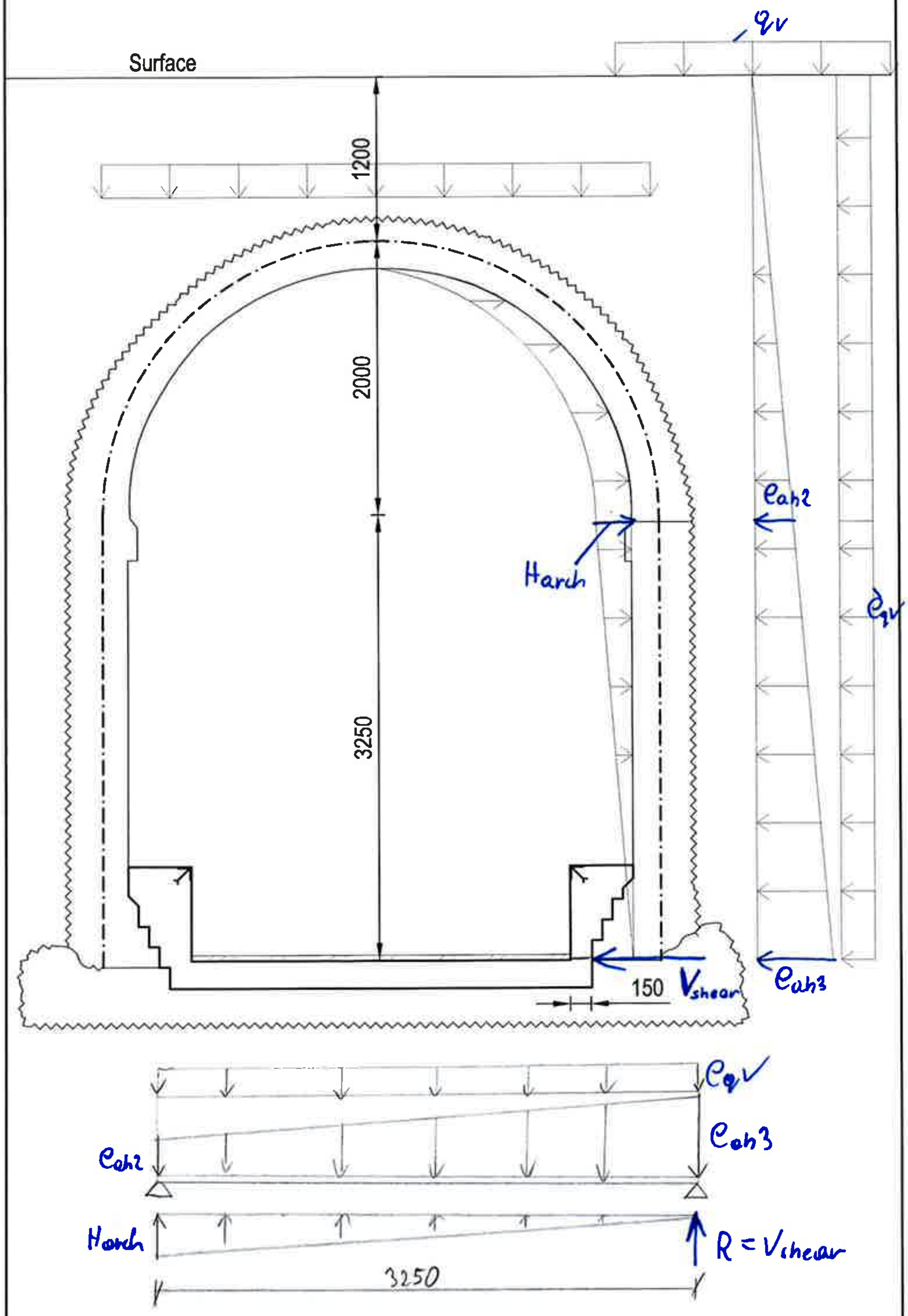
CALCULATION SHEET

CROUCH WATERFALL

Project Title	Job No	By	Date
Hayling Farm Bridge	14-3116	MW	Mar '16
	Checked	Date	Page of
	SC	Mar '16	4 20

References

Results



0. General information

Design assumption:

1. Goal post is design for maximum span length of 10.00m and height of 5.00m.
2. Design working life - 25 years
3. Dee shackle is design to break before failure of the goal post construction for easier maintanance.
Due this the below min requirement must have place:
- Chain thickness min 10mm - min. S235
- U ring thickness min 12mm - min. S235
- Full length 6mm weld for U ring.
- Dee shackle must be 6mm thick and made of S235.

4. Foundation calculation based on estimated conservatively groud parameters.

1. Entry parametrs

$L_0 := 10\ m$ Span length

$H := 5\ m$ Height

$$A_{sign} := \pi \cdot \left(\frac{750\ mm}{2}\right)^2 + 2 \cdot 3.5\ m \cdot 0.3\ m = 2.542\ m^2$$

Height restriction bar CHS 88.9x4

$h_{bar} := 90\ mm$

$l_{bar} := L_0 - 1.5\ m = 8.5\ m$

2. Actions and Loads

EC 1991-1-4 **Wind actions**

Wind conservative assumption

$w_d := 1.3\ \frac{kN}{m^2}$ Taken from Sign Structures Guide 2010. Calculated using BS EN 1991-1-4 England Hmax 7m d<5km from the shoreline. Conservative estimation.

$c_s c_d := 1$

$c_{f.sign} := 1.8$

$c_{f.post} := 2.1$

$q_{w.sign} := c_s c_d \cdot c_{f.sign} \cdot w_d = 2.34\ kPa$

$q_{w.post} := c_s c_d \cdot c_{f.post} \cdot w_d = 2.73\ kPa$

$F_{w.sign} := A_{sign} \cdot q_{w.sign} = 5.948\ kN$

$h := 150\ mm$ Post width

$F_{w.post} := q_{w.post} \cdot h = 0.41\ \frac{kN}{m}$

$h_{bar} = 90\ mm$

$F_{w.bar} := q_{w.post} \cdot h_{bar} = 0.246\ \frac{kN}{m}$

Self-weight

$G_{sign} := 0.25 \frac{kN}{m}$

$G_{bar} := 0.15 \frac{kN}{m}$

Tab. NA.A2.4 **Design values of actions**

$\gamma_{G1} := 1.35$	Concrete self weight, Ballast, Soil, Other
$\gamma_{G2} := 1.2$	Steel self weight, Super-imposed dead, Road surface
$\gamma_{Q1} := 1.35$	Road traffic, Pedestrian
$\gamma_{Q2} := 1.7$	Rail traffic actions
$\gamma_{T} := 1.55$	Thermal actions
$\gamma_{QW} := 1.55$	Wind actions - NOTE 5 - design for 50 years

3. Material properties & beam cross sections

EC 1993-2 Tab.6.1 $\gamma_{M0} := 1$ $\gamma_{M1} := 1.1$ $\gamma_{M2} := 1.25$ $\gamma_{M3} := 1.25$

Materal properties:

EC 1993-1-1 **Steel parameters: S235**

$E := 210000 \cdot MPa$ $G := 81000 \cdot MPa$ $f_y := 235 \cdot MPa$ $v := 0.3$

$\gamma_{steel} := 78.5 \frac{kN}{m^3}$ $\alpha_{Tsteal} := 1.2 \cdot 10^{-5}$ $f_u := 360 \cdot MPa$

EC 1992-1-1 **Concrete C30/37** $\alpha_{cc} := 0.85$ $\gamma_C := 1.5$ $\alpha_{ct} := 1$

Tab.3.1 $f_{ck} := 30\ MPa$ $f_{cm} := f_{ck} + 8\ MPa = 38\ MPa$ $\alpha_{Tconc} := 1.2 \cdot 10^{-5}$ Ciria C660

$$f_{ctm} := 0.3 \cdot \left(\frac{f_{ck}}{MPa}\right)^{\frac{2}{3}} \cdot MPa = 2.896\ MPa \qquad f_{ctk} := 0.7 \cdot f_{ctm} = 2.028\ MPa$$

$$f_{cd} := \alpha_{cc} \cdot \frac{f_{ck}}{\gamma_C} = 17\ MPa \qquad f_{ctd} := \alpha_{ct} \cdot \frac{f_{ctk}}{\gamma_C} = 1.352\ MPa$$

$$E_{cm} := 22 \left(0.1 \cdot \frac{f_{cm}}{MPa}\right)^{0.3} \cdot GPa = 32.837\ GPa \qquad \gamma_{conc} := 25 \frac{kN}{m^3}$$

EC 1992-1-1 **Reinforcement R500B** $\gamma_S := 1.15$

$f_{yk} := 500\ MPa$ $E_s := 200\ GPa$ $f_{yd} := \frac{f_{yk}}{\gamma_S} = 434.783\ MPa$

3. Member design

Blue book **Section properties**

SHS 200x150x8 Celcius

$h := 200\ mm$	$A := 44.8\ cm^2$		
$b := 150\ mm$	$t := 8\ mm$		
$I_y := 2970\ cm^4$	$W_{el.y} := 297\ cm^3$	$W_{pl.y} := 359\ cm^3$	$i_y := 7.5\ cm$
$I_z := 1890\ cm^4$	$W_{el.z} := 253\ cm^3$	$W_{pl.z} := 294\ cm^3$	$i_z := 5.99$
$I_T := 3640\ cm^4$	$W_T := 398\ cm^3$	$c_w := 22$	$c_f := 15.8$

$G_s := 41.4 \frac{kg}{m} \cdot g = 0.406 \frac{kN}{m}$ $c_w = \frac{c_w}{t}$ $c_f = \frac{c_f}{t}$ $\varepsilon := \sqrt{\frac{235}{f_y} \cdot \frac{N}{mm^2}} = 1$

Cross section classification

WEB CHECK

$classB := \text{if}\left(c_w \le 73, 1, \text{if}\left(c_w \le 83, 2, \text{if}\left(c_w \le 124, 3, 4\right)\right)\right) = 1$

$classC := \text{if}\left(c_w \le 33, 1, \text{if}\left(c_w \le 38, 2, \text{if}\left(c_w \le 42, 3, 4\right)\right)\right) = 1$

$classBC := \text{if}\left(c_w \le 33, 1, \text{if}\left(c_w \le 38, 2, \text{if}\left(c_w \le 42, 3, 4\right)\right)\right) = 1$

FLANGE CHECK

$classB := \text{if}\left(c_f \le 73, 1, \text{if}\left(c_f \le 83, 2, \text{if}\left(c_f \le 124, 3, 4\right)\right)\right) = 1$

$classC := \text{if}\left(c_f \le 33, 1, \text{if}\left(c_f \le 38, 2, \text{if}\left(c_f \le 42, 3, 4\right)\right)\right) = 1$

$classBC := \text{if}\left(c_f \le 33, 1, \text{if}\left(c_f \le 38, 2, \text{if}\left(c_f \le 42, 3, 4\right)\right)\right) = 1$ $\quad class := 1$

Loads and internal force calculation

Self-weight:

$q_{k.top} := G_s + G_{sign} + G_{bar} = 0.806\ \frac{kN}{m}$ $\quad q_k := q_{k.top}$ SLS load

$q_{d.top} := G_s \cdot \gamma_{G2} + G_{sign} \cdot \gamma_{G2} + G_{bar} \cdot \gamma_{G2} = 0.967\ \frac{kN}{m}$ $\quad q_d := q_{d.top}$ ULS load

$p := \frac{I_y}{I_y} = 1$ $\quad e := \frac{H}{L_0} = 0.5$

$M_K := \frac{q_d \cdot L_0^2}{24} \cdot \frac{3\ p \cdot e + 2}{p \cdot e + 2} = 5.642\ kN \cdot m$ Mid span bending moment

$M_C := \frac{q_d \cdot L_0^2}{6 \cdot (p \cdot e + 2)} = 6.448\ kN \cdot m$ Edge bending moment

$M_A := \frac{q_d \cdot L_0^2}{12 \cdot (p \cdot e + 2)} = 3.224\ kN \cdot m$ Foundation bending moment

$H_A := \frac{q_d \cdot L_0^2}{4 \cdot H \cdot (p \cdot e + 2)} = 1.934\ kN$ Foundation reaction - Horizontal

$V_A := \left(q_{d.top} \cdot L_0 + 2 \cdot H \cdot G_s \cdot \gamma_{G2}\right) \cdot 0.5 = 7.272\ kN$ Foundation reaction - Vertical

Foundation connection forces

$$H_{Ek.SW} := \frac{q_{k.top} \cdot L_0^2}{4 \cdot H \cdot (p \cdot e + 2)} = 1.612\ kN$$

$$H_{Ed.SW} := \frac{q_{d.top} \cdot L_0^2}{4 \cdot H \cdot (p \cdot e + 2)} = 1.934\ kN$$

$$V_{Ek.SW} := \left(q_{k.top} \cdot L_0 + 2 \cdot H \cdot G_s\right) \cdot 0.5 = 6.06\ kN$$

$$V_{Ed.SW} := \left(q_{d.top} \cdot L_0 + 2 \cdot H \cdot G_s \cdot \gamma_{G2}\right) \cdot 0.5 = 7.272\ kN$$

$$M_{Ek.SW} := \frac{q_{k.top} \cdot L_0^2}{12 \cdot (p \cdot e + 2)} = 2.687\ kN \cdot m$$

$$M_{Ed.SW} := \frac{q_{d.top} \cdot L_0^2}{12 \cdot (p \cdot e + 2)} = 3.224\ kN \cdot m$$

Wind:

$F_{w.d.sign} := F_{w.sign} \cdot \gamma_{QW} = 9.219\ kN$

$F_{w.d.post} := F_{w.post} \cdot \gamma_{QW} = 0.635\ \frac{1}{m} \cdot kN$

$F_{k.top} := F_{w.sign} + F_{w.post} \cdot 2\ m + F_{w.bar} \cdot l_{bar} = 8.855\ kN$

$F_{d.top} := F_{k.top} \cdot \gamma_{QW} = 13.726\ kN$

Foundation connection forces

$M_{Ek.Wind} := \left(F_{k.top} \cdot H + 2\ F_{w.post} \cdot H^2 \cdot 0.5\right) \cdot 0.5 = 27.257\ kN \cdot m$

$M_{Ed.Wind} := \left(F_{d.top} \cdot H + 2\ F_{w.d.post} \cdot H^2 \cdot 0.5\right) \cdot 0.5 = 42.248\ kN \cdot m$

$Q_{Ek.Wind} := \left(F_{k.top} + 2\ F_{w.post} \cdot H\right) \cdot 0.5 = 6.475\ kN$

$Q_{Ed.Wind} := \left(F_{d.top} + 2\ F_{w.d.post} \cdot H\right) \cdot 0.5 = 10.036\ kN$

$M_{T.Ed.Wind} := \frac{F_{d.top}}{L_0} \cdot L_0^{\ 2} \cdot \frac{1}{12} = 11.438\ kN \cdot m$

Accidental - lorry impact - breaking Dee Shackle - with Screwed Collar Pin - load 500kg

$t_{shackle} := 6\ mm$ Thickness of Dee Shackle

$n_{shackle} := 2$

$f_u := 360\ MPa$ S235 - ultimate tensile strength

$\sigma_{demage} := \frac{f_u}{1.3} = 276.923\ MPa$

$F_{shackle.break} := \sigma_{demage} \cdot \pi \cdot \left(\frac{t_{shackle}}{2}\right)^2 \cdot n_{shackle} = 15.66\ kN$ Assumption of breaking force

Foundation connection forces

$F_{accident} := F_{shackle.break} = 15.66\ kN$

$M_{accident} := \left(F_{accident} \cdot H\right) \cdot 0.5 = 39.149\ kN \cdot m$

$Q_{accident} := \left(F_{accident}\right) \cdot 0.5 = 7.83\ kN$

$M_{T.accident} := \frac{F_{accident}}{L_0} \cdot L_0^{\ 2} \cdot \frac{1}{12} = 13.05\ kN \cdot m$

Member - check - worse case

$M_{y.Ed} := M_{Ed.Wind} = 42.248\ kN \cdot m$ $\quad M_{z.Ed} := M_{Ed.SW} = 3.224\ kN \cdot m$

$V_{y.Ed} := Q_{Ed.Wind} = 10036.429\ N$ $\quad V_{z.Ed} := H_{Ed.SW} = 1.934\ kN$

$M_{T.Ed} := M_{T.Ed.Wind} = 11.438\ kN \cdot m$ $\quad N_{Ed} := V_{Ed.SW} = 7.272\ kN$

6.2.4 Compression members

$N_{EdC} := \text{if}\left(N_{Ed} \geq 0, |N_{Ed}|, 0\ kN\right) = 7.272\ kN$

$N_{c.Rd} := \dfrac{A \cdot f_y}{\gamma_{M0}} = 1052.8\ kN$ Design resistance - Class 1,2 or 3 $class = 1$

$\dfrac{N_{EdC}}{N_{c.Rd}} \leq 1 = 1$ $\quad \dfrac{N_{EdC}}{N_{c.Rd}} = 0.007$ **PASS**

$N_{pl.Rd} := \dfrac{A \cdot f_y}{\gamma_{M0}} = 1052.8\ kN$ Design plastic resistance of the gross cross-section

6.2.5 Bending members

$M_{y.pl.Rd} := \dfrac{W_{pl.y} \cdot f_y}{\gamma_{M0}} = 84.365\ kN \cdot m$ Design resistance - Class 1,2 $class = 1$

$\dfrac{M_{y.Ed}}{M_{y.pl.Rd}} \leq 1 = 1$ $\quad \dfrac{M_{y.Ed}}{M_{y.pl.Rd}} = 0.501$ **PASS**

$M_{z.pl.Rd} := \dfrac{W_{pl.z} \cdot f_y}{\gamma_{M0}} = 69.09\ kN \cdot m$ Design resistance - Class 1,2 $class = 1$

$\dfrac{M_{z.Ed}}{M_{z.pl.Rd}} \leq 1 = 1$ $\quad \dfrac{M_{z.Ed}}{M_{z.pl.Rd}} = 0.047$ **PASS**

6.2.6 Shear members

$A_{yV} := \dfrac{A \cdot h}{b + h} = 2560\ mm^2$ see: 3.2.6 (3)

$A_{zV} := \dfrac{A \cdot b}{b + h} = 1920\ mm^2$ see: 3.2.6 (3)

$V_{y.pl.Rd} := A_{yV} \cdot \left(\dfrac{f_y}{\sqrt{3}}\right) \cdot \dfrac{1}{\gamma_{M0}} = 347.334\ kN$ Design plastic shear resistance

$V_{z.pl.Rd} := A_{zV} \cdot \left(\dfrac{f_y}{\sqrt{3}}\right) \cdot \dfrac{1}{\gamma_{M0}} = 260.5\ kN$ Design plastic shear resistance

$\dfrac{V_{y.Ed}}{V_{y.pl.Rd}} \leq 1 = 1$ $\quad \dfrac{V_{y.Ed}}{V_{y.pl.Rd}} = 0.029$ **PASS**

$\dfrac{V_{z.Ed}}{V_{z.pl.Rd}} \leq 1 = 1$ $\quad \dfrac{V_{z.Ed}}{V_{z.pl.Rd}} = 0.007$ **PASS**

$\eta := 1.2$

$\text{if}\left(\dfrac{h - 2\,t}{t} > \dfrac{72 \cdot \varepsilon}{\eta}, \text{“Check for shear buckling”}, \text{“No shear buckling”}\right) = \text{“No shear buckling”}$

$\text{if}\left(\dfrac{b - 2\,t}{t} > \dfrac{72 \cdot \varepsilon}{\eta}, \text{“Check for shear buckling”}, \text{“No shear buckling”}\right) = \text{“No shear buckling”}$

6.2.7 **Torsion members**

$T_{t.Ed} := M_{T.Ed} = 11.438\ kN \cdot m$

(7) $T_{w.Ed} := 0\ kN \cdot m$ Torsional warping may be neglected - closed hollow section

$T_{Ed} := T_{t.Ed} + T_{w.Ed} = 11.438\ kN \cdot m$

$T_{Rd} := f_y \cdot W_T = 93.53\ kN \cdot m$ $\quad \frac{T_{Ed}}{T_{Rd}} \le 1 = 1 \quad \frac{T_{Ed}}{T_{Rd}} = 0.122$ **PASS**

9.2.7(9) Combined shear and torsion moment - reduction

$A_0 := (h - t) \cdot (b - t) = 27264\ mm^2$

$\tau_{t.Ed} := \frac{T_{Ed}}{2\ A_0 \cdot t} = 26.22\ MPa$ Torsion stress

(6.28) $V_{y.pl.T.Rd} := \left(1 - \frac{\tau_{t.Ed}}{\left(\frac{f_y}{\sqrt{3}} \cdot \frac{1}{\gamma_{M0}}\right)}\right) \cdot V_{y.pl.Rd} = 280.209\ kN$ Structural hollow section

(6.28) $V_{z.pl.T.Rd} := \left(1 - \frac{\tau_{t.Ed}}{\left(\frac{f_y}{\sqrt{3}} \cdot \frac{1}{\gamma_{M0}}\right)}\right) \cdot V_{z.pl.Rd} = 210.157\ kN$ Structural hollow section

$\frac{V_{y.Ed}}{V_{y.pl.T.Rd}} \le 1 = 1 \quad \frac{V_{y.Ed}}{V_{y.pl.T.Rd}} = 0.036$ **PASS**

$\frac{V_{z.Ed}}{V_{z.pl.T.Rd}} \le 1 = 1 \quad \frac{V_{z.Ed}}{V_{z.pl.T.Rd}} = 0.009$ **PASS**

6.2.9 **Bending and axial**

Class 1 and 2 cross-section

(6.32) $M_{y.N.Rd} := M_{y.pl.Rd} \cdot \left(1 - \left(\frac{|N_{Ed}|}{N_{pl.Rd}}\right)^2\right) = 84.361\ kN \cdot m$

(6.32) $M_{z.N.Rd} := M_{z.pl.Rd} \cdot \left(1 - \left(\frac{|N_{Ed}|}{N_{pl.Rd}}\right)^2\right) = 69.087\ kN \cdot m$

(6.31) $\frac{M_{y.Ed}}{M_{y.N.Rd}} \le 1 = 1 \quad \frac{M_{y.Ed}}{M_{y.N.Rd}} = 0.501$ **PASS**

(6.31) $\frac{M_{z.Ed}}{M_{z.N.Rd}} \le 1 = 1 \quad \frac{M_{z.Ed}}{M_{z.N.Rd}} = 0.047$ **PASS**

Bi-axial bending

$n_{biaxial} := \frac{|N_{Ed}|}{N_{pl.Rd}} = 0.007$

$\alpha_{biaxial} := \frac{1.66}{1 - 1.13\ n_{biaxial}^{\ 2}} = 1.66 \quad \beta_{biaxial} := \alpha_{biaxial} = 1.66$ Rectangular hollow sections

(6.41) $\left(\frac{M_{y.Ed}}{M_{y.N.Rd}}\right)^{\alpha_{biaxial}} + \left(\frac{M_{z.Ed}}{M_{z.N.Rd}}\right)^{\beta_{biaxial}} \le 1 = 1 \quad \left(\frac{M_{y.Ed}}{M_{y.N.Rd}}\right)^{\alpha_{biaxial}} + \left(\frac{M_{z.Ed}}{M_{z.N.Rd}}\right)^{\beta_{biaxial}} = 0.323$ **PASS**

SLS - check

Wind force Equivalent to 1-year Return Period

75% of wind force - EN 12899-1 5.4.1. note 1

$\gamma_{SLS} := 0.75$

$P := (F_{k.top}) \cdot 0.5 \cdot \gamma_{SLS} = 3.321\ kN$ $\quad q := F_{w.post} \cdot \gamma_{SLS} = 0.307\ \frac{kN}{m}$

$f_{max.H} := \frac{P \cdot H^3}{3 \cdot E \cdot I_y} + \frac{q \cdot H^4}{8\ E \cdot I_y} = 26.031\ mm$ $\quad \frac{H}{150} = 33.333\ mm$ $\quad \frac{H}{150} > f_{max.H} = 1$ **PASS**

Conservative assumption - deflection for simply supported beam

$f_{max.V} := \frac{5}{384} \cdot \frac{q_{k.top} \cdot L_0^{\ 4}}{E \cdot I_z} = 26.442\ mm$ $\quad \frac{L_0}{250} = 40\ mm$ $\quad \frac{L_0}{250} > f_{max.V} = 1$ **PASS**

4. Connections design

4.1. Design splice connection

Loads

$M_{Ed.j} := M_{T.Ed} = 11.438\ kN \cdot m$

$V_{Ed.j} := V_{y.Ed} = 10.036\ kN$

Plate dimension

$t_{pl} := 12\ mm$

$b_{pl} := 220\ mm$

Design resistance of individual bolt connection

EC 1993-1-8 **Connection made with M12 grade 8.8 bolts in 14mm holes.**

Tab. 3.1 $f_{yb} := 640 \cdot MPa$ Nominal yield strength

$f_{ub} := 800 \cdot MPa$ Ultimate tensile strength

$d := 12\ mm$ Bolt diameter

$d_0 := 14\ mm$ Whole diameter

$A_s := \pi \cdot \left(\frac{d}{2}\right)^2 = 113.097\ mm^2$ Bolt shear area

$n_b := 4$ Bolts number

Category of bolted connection - A

Bolt shear capacity

$\alpha_v := 0.6$

$F_{v.Rd} := \frac{\alpha_v \cdot f_{ub} \cdot A_s}{\gamma_{M2}} = 43.429\ kN$

Bolt spacing

$e_1 := 30\ mm$ $\qquad$ $e_1 > 1.2\ d_0 = 1$

$e_2 := 30\ mm$ $\qquad 1.2\ d_0 = 16.8\ mm$ $\qquad$ $e_2 > 1.2\ d_0 = 1$

$p_1 := 180\ mm$ $\qquad 2.2\ d_0 = 30.8\ mm$ $\qquad$ $p_1 > 2.2\ d_0 = 1$

$p_2 := 260\ mm$ $\qquad 2.4\ d_0 = 33.6\ mm$ $\qquad$ $p_2 > 2.4\ d_0 = 1$

Force on one bolt - furthest

$y_{max} := 0.5\ p_1 \qquad x_{max} := 0.5\ p_2$

$$r_1 := \sqrt{(x_{max})^2 + (y_{max})^2} = 158.114\ mm$$

Distance from middle joint to the bolts

$$a_b := \operatorname{atan}\left(\frac{y_{max}}{x_{max}}\right) = 34.695\ deg$$

$$F_{M1} := M_{Ed.j} \cdot \frac{r_1}{4 \cdot r_1^2} = 18.085\ kN$$

Force from bending moment at single bolt

$$F_{V1} := \frac{V_{Ed.j}}{n_b} = 2.509\ kN$$

$$F_{max1} := \sqrt{(F_{V1} + F_{M1} \cdot \cos(\alpha))^2 + (F_{M1} \cdot \sin(\alpha))^2} = 20.594\ kN$$

$F_{max} := \max(F_{max1}) = 20.594\ kN \qquad F_{v.Rd} > F_{max} = 1 \qquad \frac{F_{max}}{F_{v.Rd}} = 0.474$ **PASS**

3.4 **Bearing resistance**

$$k_1 := min\left(2.8 \cdot \frac{e_2}{d_0} - 1.7, 2.5\right) = 2.5 \qquad \alpha_b := min\left(\frac{e_1}{3\ d_0}, \frac{f_{ub}}{f_u}, 1\right) = 0.714$$

$$F_{b.Rd1} := \frac{k_1 \cdot \alpha_b \cdot f_u \cdot d \cdot t_{pl}}{\gamma_{M2}} = 74.057\ kN$$

$$\alpha_b := min\left(\frac{p_1}{3\ d_0}, \frac{f_{ub}}{f_u}, 1\right) = 1$$

$$F_{b.Rd2} := \frac{k_1 \cdot \alpha_b \cdot f_u \cdot d \cdot t_{pl}}{\gamma_{M2}} = 103.68\ kN$$

$F_{b.Rd} := 2\ F_{b.Rd1} + 2\ F_{b.Rd2} = 355.474\ kN \qquad F_{b.Rd} > 4\ F_{max} = 1 \qquad \frac{4\ F_{max}}{F_{b.Rd}} = 0.232$ **PASS**

3.10.2 **Design for block tearing**

Tension

$$A_{nt} := (p_2 - d_0) \cdot t_{pl} = 2952\ mm^2$$

Shear

$$A_{nv} := (2\ e_1 + 2\ p_1 - 3\ d_0) \cdot t_{pl} = 4536\ mm^2$$

$$V_{eff.1.Rd} := \frac{f_u \cdot A_{nt}}{\gamma_{M2}} + \frac{1}{\sqrt{3}} \cdot f_y \cdot \frac{A_{nv}}{\gamma_{M0}} = 1465.608\ kN$$

$V_{eff.1.Rd} > 4\ F_{max} = 1 \qquad \frac{4\ F_{max}}{V_{eff.1.Rd}} = 0.056$ **PASS**

4.2. Design foundation connection

Loads

$M_{Ed.j} := M_{T.Ed} = 11.438\ kN \cdot m$

$V_{Ed.j} := V_{y.Ed} = 10.036\ kN$

EC 1993-1-8
Lever arm Fig. 6.18 $N_{Ed.j} := \dfrac{M_{y.Ed}}{250\ mm} = 168.992\ kN$ Tension force from bending moment at joint.

$M_{y.Ed} = 42.248\ kN \cdot m$

Plate dimmentions

$t_{pl} := 18\ mm$

$b_{pl} := 350\ mm$

Design resistance of individual bolt connection

EC 1993-1-8 **Connection made with M12 grade 8.8 bolts in 14mm holes.** **Category of bolted connection - A**

Tab. 3.1 $f_{yb} := 640 \cdot MPa$ Nominal yield strength

$f_{ub} := 800 \cdot MPa$ Ultimate tensile strength

$d := 12\ mm$ Bolt diameter

$d_0 := 14\ mm$ Hole diameter

$d_m := 18\ mm$ Bolt head diameter

$A_s := \pi \cdot \left(\dfrac{d}{2}\right)^2 = 113.097\ mm^2$ Bolt shear area

$n_b := 6$ Bolts number

Bolt shear capacity

$\alpha_v := 0.6$

$F_{v.Rd} := \dfrac{\alpha_v \cdot f_{ub} \cdot A_s}{\gamma_{M2}} = 43.429\ kN$

Bolt tensile capacity

$k_2 := 0.9$

$F_{t.Rd} := \dfrac{k_2 \cdot f_{ub} \cdot A_s}{\gamma_{M2}} = 65.144\ kN$ Tensile bolt resistance

$B_{p.Rd} := \dfrac{0.6 \cdot \pi \cdot d_m \cdot t_{pl} \cdot f_u}{\gamma_{M2}} = 175.889\ kN$ Tensile plate resistance

$F_{t.Rd} := min\left(F_{t.Rd}, B_{p.Rd}\right) = 65.144\ kN$

Bolt spacing

$e_1 := 50\ mm$	$1.2\ d_0 = 16.8\ mm$	$e_1 > 1.2\ d_0 = 1$
$e_2 := 50\ mm$		$e_2 > 1.2\ d_0 = 1$
$p_1 := 125\ mm$	$2.2\ d_0 = 30.8\ mm$	$p_1 > 2.2\ d_0 = 1$
$p_2 := 300\ mm$	$2.4\ d_0 = 33.6\ mm$	$p_2 > 2.4\ d_0 = 1$

Shear resistance greather than splice connection - equal shear forces **PASS**

1993-1-8 **Local bending resistance of the joint**

6.2.4 Tensile resistance of the group

Tab. 6.4 $l_{eff.1} := 2 \cdot p_1 + 2 \cdot e_2 = 350\ mm$ — Effective length of end plate

$l_{eff.2} := l_{eff.1} = 350\ mm$

$m_{bolt} := \frac{n_b}{2} = 3$ — Number of bolts in tension

Tab. 6.2 $n_{dist} := e_1 = 50\ mm$

$m_{dist} := e_1 = 50\ mm$

Defect model 1

$$M_{pl.1.Rd} := \frac{0.25\ l_{eff.1} \cdot t_{pl}^{2} \cdot f_y}{\gamma_{M0}} = 6.662\ kN \cdot m$$

$$F_{T.1.Rd} := \frac{4 \cdot M_{pl.1.Rd}}{m_{dist}} = 532.98\ kN$$

Defect model 2

$$M_{pl.2.Rd} := \frac{0.25\ l_{eff.2} \cdot t_{pl}^{2} \cdot f_y}{\gamma_{M0}} = 6.662\ kN \cdot m$$

$$F_{T.2.Rd} := \frac{2 \cdot M_{pl.2.Rd} + n_{dist} \cdot m_{bolt} \cdot F_{t.Rd}}{m_{dist} + n_{dist}} = 230.961\ kN$$

Defect model 3

$$F_{T.3.Rd} := m_{bolt} \cdot F_{t.Rd} = 195.432\ kN$$

$F_{T.min.Rd} := min\left(F_{T.1.Rd}, F_{T.2.Rd}, F_{T.3.Rd}\right) = 195.432\ kN$ $F_{T.min.Rd} > N_{Ed.j} = 1$ $\frac{N_{Ed.j}}{F_{T.min.Rd}} = 0.865$ **PASS**

Bolts anchorage capacity $f_{ck} = 30\ MPa$

$d_{eff} := 480\ mm = 0.48\ m$ — Anchor length

$b_w := 2 \cdot 350\ mm + 2 \cdot 100\ mm = 0.9\ m$ — Control perimeter - conservatively perimeter of set of washer plates

$$k := min\left(1 + \sqrt{\frac{200 \cdot mm}{d_{eff}}}, 2\right) = 1.645$$

$\sigma_{cp} := 0\ MPa$ — Compression stress

NA 1992-1-2

6.4.4 (1) $k_1 := 0.1$

$$v_{min} := 0.035 \cdot k^{\frac{3}{2}} \cdot \left(\frac{f_{ck}}{MPa}\right)^{\frac{1}{2}} \cdot MPa = 0.405\ MPa$$ Minimum shear concrete capacity

$$V_{Rd.c.min} := \left(v_{min} + k_1 \cdot \sigma_{cp}\right) \cdot b_w \cdot d_{eff} = 174.807\ kN$$ Shear resistance of the section

$N_{Ed.j} < V_{Rd.c.min} = 1$ $\frac{N_{Ed.j}}{V_{Rd.c.min}} = 0.967$ **PASS**

Passive Safety check

Bolts shear due to lorry impact

BS1991-1-7 Tab. 4.1 $F_{lorry} := 500\ kN$ — Roads in urban aread - lorries impact force in travel direction

$F_{bolt.cut} := n_b \cdot \alpha_v \cdot f_{ub} \cdot A_s = 325.72\ kN$ — Cutting force - Group bolt

$F_{lorry} > 1.2\ F_{bolt.cut} = 1$ **PASS**

BS1993-1-8 Tab. 4.1 **Weld connection to foundation plate - check - butt weld**

$\beta_w := 0.8$

$a_{weld} := t = 8\ mm$

$$f_{vw.d} := \frac{f_u}{\sqrt{3} \cdot \beta_w \cdot \gamma_{M2}} = 207.846\ MPa$$

$$F_{w.Rd} := a_{weld} \cdot f_{vw.d} = 1.663\ \frac{kN}{mm}$$

$$F_{tension} := \frac{M_{y.Ed}}{h} = 211.24\ kN \qquad V_{Ed.j} = 10.036\ kN$$

$$\sigma_T := \frac{F_{tension}}{a_{weld} \cdot b} = 176.034\ MPa$$

$$\tau_T := 0\ MPa \qquad \tau_{II} := \frac{V_{Ed.j}}{2\ a_{weld} \cdot h} = 3.136\ MPa$$

$$\sigma_{weld} := \sqrt{\sigma_T^{\ 2} + 3\left(\tau_T^{\ 2} + \tau_{II}^{\ 2}\right)} = 176.117\ MPa \qquad \sigma_{weld} < \frac{f_u}{\beta_w \cdot \gamma_{M2}} = 1 \qquad \sigma_T < \frac{0.9 \cdot f_u}{\gamma_{M2}} = 1$$

PASS

All weld joints to be full penetration butt welds performed during fabrication.

4. Foundation

Design foundation pad due to EC 7

Foundation size

$B_{y.F} := 1200\ mm$ $\quad B_{z.F} := 1200\ mm$ $\quad D_F := 2000\ mm$ Depth

$A_F := B_{y.F} \cdot B_{z.F}$ $\quad V_F := A_F \cdot D_F = 2.88\ m^3$

$H_F := D_F - 100\ mm = 1900\ mm$ Bed level $\quad W_{y.F} := \frac{B_{z.F} \cdot B_{y.F}^2}{6} = 0.288\ m^3$ $\quad W_{z.F} := \frac{B_{y.F} \cdot B_{z.F}^2}{6} = 0.288\ m^3$

Estimated ground parameters - conservatively

$\gamma_{g1} := 19\ \frac{kN}{m^3}$ $\quad \phi_{g1} := 22\ deg$ $\quad c_{g1} := 0\ kPa$ $\quad v_{g1} := 0.3$

$K_{a.g1} := \left(\tan\left(45\ deg - \frac{\phi_{g1}}{2}\right)\right)^2 = 0.455$ Active $\quad K_{p.g1} := \left(\tan\left(45\ deg + \frac{\phi_{g1}}{2}\right)\right)^2 = 2.198$ Passive

$K_0 := 1 - \sin(\phi_{g1}) = 0.625$ Uncohesive ground $\quad K_0 := \frac{v_{g1}}{1 - v_{g1}} = 0.429$ Cohesive ground

$K_{0.g1} := \text{if}\left(c_{g1} = 0\ kPa, 1 - \sin(\phi_{g1}), \frac{v_{g1}}{1 - v_{g1}}\right) = 0.625$ Neutral

$K_{a.g1} := K_{a.g1} = 0.455$

$K_{p.g1} := K_{p.g1} = 2.198$

$K_{0.g1} = 0.625$

$e_{a.g1} := \left(H_F \cdot \gamma_{g1} \cdot K_{a.g1} - 2 \cdot c_{g1} \cdot \sqrt{K_{a.g1}}\right) = 16.424\ kPa$

$e_{p.g1} := H_F \cdot \gamma_{g1} \cdot K_{p.g1} + 2 \cdot c_{g1} \cdot \sqrt{K_{p.g1}} = 79.347\ kPa$

$e_{0.g1} := H_F \cdot \gamma_{g1} \cdot K_{0.g1} + 2 \cdot c_{g1} \cdot \sqrt{K_{0.g1}} = 22.577\ kPa$ $\quad H_c := \frac{2 \cdot c_{g1}}{\gamma_{g1} \cdot \sqrt{K_{a.g1}}} = 0\ m$

$H_{noAct} := 0.5\ m$ Assumption of depth of loose ground

$e_{a.noAct} := H_{noAct} \cdot \gamma_{g1} \cdot K_{a.g1} = 4.322\ kPa$

$e_{p.noAct} := H_{noAct} \cdot \gamma_{g1} \cdot K_{p.g1} = 20.881\ kPa$

$e_{0.noAct} := H_{noAct} \cdot \gamma_{g1} \cdot K_{0.g1} = 5.941\ kPa$

$E_a := 0.5 \cdot (H_F - H_c) \cdot e_{a.g1} = 15.603\ \frac{1}{m} \cdot kN$

$E_p := 2 \cdot c_{g1} \cdot \sqrt{K_{p.g1}} \cdot H_F + H_F \cdot \gamma_{g1} \cdot K_{p.g1} \cdot H_F \cdot 0.5 - H_{noAct} \cdot \gamma_{g1} \cdot K_{p.g1} \cdot H_{noAct} \cdot 0.5 = 70.16\ \frac{1}{m} \cdot kN$

$E_0 := 2 \cdot c_{g1} \cdot \sqrt{K_{0.g1}} \cdot H_F + H_F \cdot \gamma_{g1} \cdot K_{0.g1} \cdot H_F \cdot 0.5 - e_{0.noAct} \cdot H_{noAct} \cdot 0.5 = 19.963\ \frac{1}{m} \cdot kN$

$M_{y.Fa} := \left(E_a \cdot \frac{1}{3} \cdot (H_F - H_c)\right) \cdot B_{z.F} = 11.858\ kN \cdot m$

$M_{y.Fp} := \left(\left(2 \cdot c_{g1} \cdot \sqrt{K_{p.g1}} \cdot H_F\right) \cdot 0.5\ H_F + (H_F \cdot \gamma_{g1} \cdot K_{p.g1} \cdot H_F \cdot 0.5) \cdot \frac{1}{3} \cdot H_F\right) \cdot B_{z.F} = 57.289\ kN \cdot m$

$M_{y.F0} := \left(\left(2 \cdot c_{g1} \cdot \sqrt{K_{0.g1}} \cdot H_F\right) \cdot 0.5\ H_F + (H_F \cdot \gamma_{g1} \cdot K_{0.g1} \cdot H_F \cdot 0.5) \cdot \frac{1}{3} \cdot H_F\right) \cdot B_{z.F} = 16.3\ kN \cdot m$

$M_{z.Fa} := \left(E_a \cdot \frac{1}{3} \cdot (H_F - H_c)\right) \cdot B_{y.F} = 11.858\ kN \cdot m$

$M_{z.Fp} := \left(\left(2 \cdot c_{g1} \cdot \sqrt{K_{p.g1}} \cdot H_F\right) \cdot 0.5\ H_F + (H_F \cdot \gamma_{g1} \cdot K_{p.g1} \cdot H_F \cdot 0.5) \cdot \frac{1}{3} \cdot H_F\right) \cdot B_{y.F} = 57.289\ kN \cdot m$

$M_{z.F0} := \left(\left(2 \cdot c_{g1} \cdot \sqrt{K_{0.g1}} \cdot H_F\right) \cdot 0.5\ H_F + (H_F \cdot \gamma_{g1} \cdot K_{0.g1} \cdot H_F \cdot 0.5) \cdot \frac{1}{3} \cdot H_F\right) \cdot B_{y.F} = 16.3\ kN \cdot m$

BS1997-1 Annex A Values of partial factors -foundation

Case B

$\gamma_{G.B} := 1.35$ $\gamma_{Q.B} := 1.5$

$\gamma_{\phi.B} := 1$ $\gamma_{c.B} := 1$

$\gamma_{cu.B} := 1$ $\gamma_{qu.B} := 1$

$\gamma_{\gamma.B} := 1$

Case C

$\gamma_{G.C} := 1.0$ $\gamma_{Q.C} := 1.3$

$\gamma_{\phi.C} := 1.25$ $\gamma_{c.C} := 1.25$

$\gamma_{cu.C} := 1.4$ $\gamma_{qu.C} := 1.4$

$\gamma_{\gamma.C} := 1$

Further calculation base on partial factors for $Case := \text{"B"}$

$\gamma_G := \text{if}\left(Case = \text{"B"}, \gamma_{G.B}, \gamma_{G.C}\right) = 1.35$

$\gamma_Q := \text{if}\left(Case = \text{"B"}, \gamma_{Q.B}, \gamma_{Q.C}\right) = 1.5$

$\gamma_\phi := \text{if}\left(Case = \text{"B"}, \gamma_{\phi.B}, \gamma_{\phi.C}\right) = 1$

$\gamma_c := \text{if}\left(Case = \text{"B"}, \gamma_{c.B}, \gamma_{c.C}\right) = 1$

$\gamma_{cu} := \text{if}\left(Case = \text{"B"}, \gamma_{qu.B}, \gamma_{cu.C}\right) = 1$

$\gamma_{qu} := \text{if}\left(Case = \text{"B"}, \gamma_{qu.B}, \gamma_{qu.C}\right) = 1$

$\gamma_\gamma := \text{if}\left(Case = \text{"B"}, \gamma_{\gamma.B}, \gamma_{\gamma.C}\right) = 1$

Forces in connection to the foundation pad from structure

$M_{y.Ed} := M_{Ek.Wind} \cdot \gamma_Q = 40.885\ kN \cdot m$

$M_{z.Ed} := M_{Ek.SW} \cdot \gamma_G = 3.627\ kN \cdot m$

$V_{y.Ed} := Q_{Ek.Wind} \cdot \gamma_Q = 9.713\ kN$

$V_{z.Ed} := H_{Ek.SW} \cdot \gamma_G = 2.176\ kN$

$N_{Ed} := V_{Ek.SW} = 6.06\ kN$

Forces at the bottom of foundation

$M_{y.Ed.F} := M_{y.Ed} + V_{y.Ed} \cdot H_F - M_{y.Fp} + M_{y.Fa} = 13.909\ kN \cdot m$

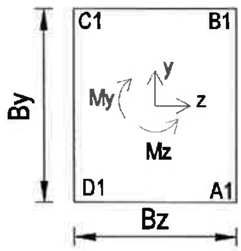
$M_{y.Ed.F0} := M_{y.Ed} + V_{y.Ed} \cdot H_F - M_{y.F0} + M_{y.Fa} = 54.897\ kN \cdot m$

$M_{y.Ed.F} := \text{if}\left(M_{y.Ed.F} > 0\ kN \cdot m, M_{y.Ed.F}, 0\ kN \cdot m\right) = 13.909\ kN \cdot m$

$M_{z.Ed.F} := M_{z.Ed} + V_{z.Ed} \cdot H_F - M_{z.Fp} + M_{z.Fa} = -37.669\ kN \cdot m$

$M_{z.Ed.F0} := M_{z.Ed} + V_{z.Ed} \cdot H_F - M_{z.F0} + M_{z.Fa} = 3.32\ kN \cdot m$

$M_{z.Ed.F} := \text{if}\left(M_{z.Ed.F} > 0\ kN \cdot m, M_{z.Ed.F}, 0\ kN \cdot m\right) = 0\ kN \cdot m$



$G_{F.k.SW} := B_{z.F} \cdot B_{y.F} \cdot D_F \cdot \gamma_{conc} = 72\ kN$ Foundation weigth

$G_{F.d.SW} := G_{F.k.SW} \cdot \gamma_G = 97.2\ kN$

$N_{Ed.F} := N_{Ed} + G_{F.d.SW} = 103.26\ kN$

$e_y := \dfrac{M_{y.Ed.F}}{N_{Ed.F}} = 0.135\ m$ $e_z := \dfrac{M_{z.Ed.F}}{N_{Ed.F}} = 0\ m$ $e_y < \dfrac{B_{y.F}}{6} = 1$ $e_z < \dfrac{B_{z.F}}{6} = 1$

$\sigma_{C1} := \dfrac{N_{Ed.F}}{B_{y.F} \cdot B_{z.F}} + \dfrac{M_{y.Ed.F}}{W_{y.F}} - \dfrac{M_{z.Ed.F}}{W_{z.F}} = 120.003\ kPa$

$\sigma_{B1} := \dfrac{N_{Ed.F}}{B_{y.F} \cdot B_{z.F}} + \dfrac{M_{y.Ed.F}}{W_{y.F}} + \dfrac{M_{z.Ed.F}}{W_{z.F}} = 120.003\ kPa$

$\sigma_{D1} := \dfrac{N_{Ed.F}}{B_{y.F} \cdot B_{z.F}} - \dfrac{M_{y.Ed.F}}{W_{y.F}} - \dfrac{M_{z.Ed.F}}{W_{z.F}} = 23.414\ kPa$

$\sigma_{A1} := \dfrac{N_{Ed.F}}{B_{y.F} \cdot B_{z.F}} - \dfrac{M_{y.Ed.F}}{W_{y.F}} + \dfrac{M_{z.Ed.F}}{W_{z.F}} = 23.414\ kPa$

$\sigma_{max} := \max\left(\sigma_{A1}, \sigma_{B1}, \sigma_{C1}, \sigma_{D1}\right) = 120.003\ kPa$

ULS - Bearing resistance

$N_{Ed.F}=103.26\ kN$ $\qquad V_{y.Ed}=9.713\ kN$ $\qquad V_{z.Ed}=2.176\ kN$

Variable value adjustment

$B:=B_{y.F}=1.2\ m$ $\qquad e_B:=\frac{M_{y.Ed.F}}{N_{Ed.F}}=0.135\ m$ $\qquad e_L:=\frac{M_{z.Ed.F}}{N_{Ed.F}}=0\ m$

$L:=B_{z.F}=1.2\ m$

Factored ground properties - at foundation level

$\phi'_d:=\frac{\phi_{g1}}{\gamma_\phi}=22\ deg$ $\qquad c':=\frac{c_{g1}}{\gamma_c}=0\ kPa$ $\qquad \gamma'_{g.d}:=\frac{\gamma_{g1}}{\gamma_\gamma}=19\ \frac{kN}{m^3}$

$B':=B-2\cdot e_B=0.931\ m$

$L':=L-2\cdot e_L=1.2\ m$

$A':=B'\cdot L'=1.117\ m^2$ $\qquad$ Effective size of foundation

Drained conditions $\qquad Bearing=\frac{R_D}{A'}$

Bearing capacity factors

Tab.6.5 $N_q:=e^{\pi\cdot\tan(\phi'_d)}\cdot\left(\tan\left(45+\frac{\phi'_d}{2}\right)\right)^2=2.909$

$N_c:=(N_q-1)\cdot\cot(\phi'_d)=4.724$

$N_\gamma:=2\ (N_q-1)\cdot\tan(\phi'_d)=1.542$

Shape factors

$s_q:=1+\left(\frac{B'}{L'}\right)\cdot\sin(\phi'_d)=1.291$

$s_\gamma:=1-0.3\cdot\left(\frac{B'}{L'}\right)=0.767$

$s_c:=\frac{(s_q\cdot N_q-1)}{(N_q-1)}=1.443$

$\theta:=\operatorname{atan}\left(\frac{V_{z.Ed}}{V_{y.Ed}}\right)=12.629\ deg$

$m_B:=\frac{2+\left(\frac{B'}{L'}\right)}{1+\left(\frac{B'}{L'}\right)}=1.563$ $\qquad m_L:=\frac{2+\left(\frac{L'}{B'}\right)}{1+\left(\frac{L'}{B'}\right)}=1.437$ $\qquad m:=m_L\cdot\cos(2\ \theta)+m_B\cdot\sin(2\ \theta)=1.966$

The load inclination factors

$i_q:=\left(1-\frac{V_{y.Ed}}{(N_{Ed.F}+A'\cdot c'\cdot\cot(\phi'_d))}\right)^m=0.823$

$i_\gamma:=\left(1-\frac{V_{y.Ed}}{(N_{Ed.F}+A'\cdot c'\cdot\cot(\phi'_d))}\right)^{m+1}=0.746$

$i_c:=i_q-\frac{(1-i_q)}{(N_c\cdot\tan(\phi'_d))}=0.731$

The base inclination factors $\qquad \alpha:=0$ Inclination base to the horizontal (radians)

$b_q:=(1-\alpha\cdot\tan(\phi'_d))^2=1$

$b_\gamma:=b_q$

$b_c:=b_q-\frac{1-b_q}{N_c\cdot\tan(\phi'_d)}=1$

$q:=D_F\cdot\gamma_{g1}=38\ kPa$

Assumption - the water table is at depth :

$q':=D_F\cdot\gamma'_{g.d}=38\ kPa$ $\qquad \gamma':=\gamma'_{g.d}=19\ \frac{kN}{m^3}$

$Bearing:=c'\cdot N_c\cdot b_c\cdot s_c\cdot i_c+q'\cdot N_q\cdot b_q\cdot s_q\cdot i_q+\frac{1}{2}\cdot\gamma'\cdot B'\cdot N_\gamma\cdot b_\gamma\cdot s_\gamma\cdot i_\gamma=125.26\ kPa$

$$Bearing := c' \cdot N_c \cdot s_c \cdot i_c + q' \cdot N_q \cdot s_q \cdot i_q + \frac{1}{2} \cdot \gamma' \cdot B' \cdot N_\gamma \cdot s_\gamma \cdot i_\gamma = 125.26\ kPa$$

$Bearing > \sigma_{max} = 1$ $\qquad \frac{\sigma_{max}}{Bearing} = 0.958$ **PASS**

Undrained conditions

$c_u := 20\ kPa$ Estimated shear resistance - conservatively

$\alpha := 0$ Inclination base to the horizontal (radians)

$$b_c := 1 - \frac{2 \cdot \alpha}{\pi + 2} = 1$$

$$s_c := 1 + 0.2 \cdot \left(\frac{B'}{L'}\right) = 1.155$$

$$i_c := 0.5 \cdot \left(1 + \sqrt{1 - \frac{V_{y.Ed}}{A' \cdot c_u}}\right) = 0.876$$

$$Bearing.undrained := (2 + \pi) \cdot c_u \cdot s_c \cdot i_c + q = 142.037\ kPa$$

$\rho_{water} := 1000\ \frac{kg}{m^3}$ $\qquad D_{water} := 1.9\ m$ $\qquad$ Water level

$V_{w.p} := \text{if}\left(D_{water} < H_F, (D_{water} - H_F) \cdot A_F \cdot g \cdot \rho_{water}, 0\ kN\right) = 0\ kN$ $\qquad \sigma_{water} := \frac{V_{w.p}}{B_{y.F} \cdot B_{z.F}} = 0\ kPa$

$$\sigma_{C1} := \frac{V_{w.p} + N_{Ed.F}}{B_{y.F} \cdot B_{z.F}} + \frac{M_{y.Ed.F}}{W_{y.F}} - \frac{M_{z.Ed.F}}{W_{z.F}} = 120.003\ kPa \qquad \sigma_{B1} := \frac{V_{w.p} + N_{Ed.F}}{B_{y.F} \cdot B_{z.F}} + \frac{M_{y.Ed.F}}{W_{y.F}} + \frac{M_{z.Ed.F}}{W_{z.F}} = 120.003\ kPa$$

$$\sigma_{D1} := \frac{V_{w.p} + N_{Ed.F}}{B_{y.F} \cdot B_{z.F}} - \frac{M_{y.Ed.F}}{W_{y.F}} - \frac{M_{z.Ed.F}}{W_{z.F}} = 23.414\ kPa \qquad \sigma_{A1} := \frac{V_{w.p} + N_{Ed.F}}{B_{y.F} \cdot B_{z.F}} - \frac{M_{y.Ed.F}}{W_{y.F}} + \frac{M_{z.Ed.F}}{W_{z.F}} = 23.414\ kPa$$

$$\sigma_{max} := \max\left(\sigma_{A1}, \sigma_{B1}, \sigma_{C1}, \sigma_{D1}\right) = 120.003\ kPa$$

$Bearing.undrained > \sigma_{max} = 1$ $\qquad \frac{\sigma_{max}}{Bearing.undrained} = 0.845$ **PASS**

PAVEMENT DESIGN USING THE DESIGN MANUAL FOR ROADS AND BRIDGES

TEDDS calculation version 2.0.00

Design traffic

Million standard axles — msa = **1**

Subgrade assessment

California Bearing Ratio — CBR = **15.00%**

Foundation design (IAN 73/06 (Draft HD 25))

Sub-base material — **MCHW1 Series 600**

Foundation class (Fig 4.1) — **Class 1**

Capping thickness required (Fig. 4.1) — h_{Cap_req} = **200** mm

Thickness of capping layer provided — h_{Cap} = **200** mm

PASS - The thickness of the capping layer provided is adequate

Pavement design (HD 26/06)

Type of pavement — **Continuously reinforced concrete pavement**

Surface course material — **TSCS**

Thickness of surface course — h_{surf_basic} = **30** mm

Binder course material — **None**

Thickness of binder course — h_{bind} = **0** mm

Mean concrete flexural strength at 28 days — f_f = **5.0** MPa

Min. 1m edge strip/tied hard shoulder present — **Yes**

Thickness of CRCP provided — h_{conc} = **200** mm

Thickness of CRCP required (Fig. 2.2) — h_{conc_req} = **200** mm

PASS - The thickness of CRCP provided is adequate

Area of longitudinal crack control steel required — $A_{sl\_req} = 0.6\% \times h_{conc}$ = **1200** mm²/m

Longitudinal reinforcement provided — **H16 bars at 150 mm ctrs.**

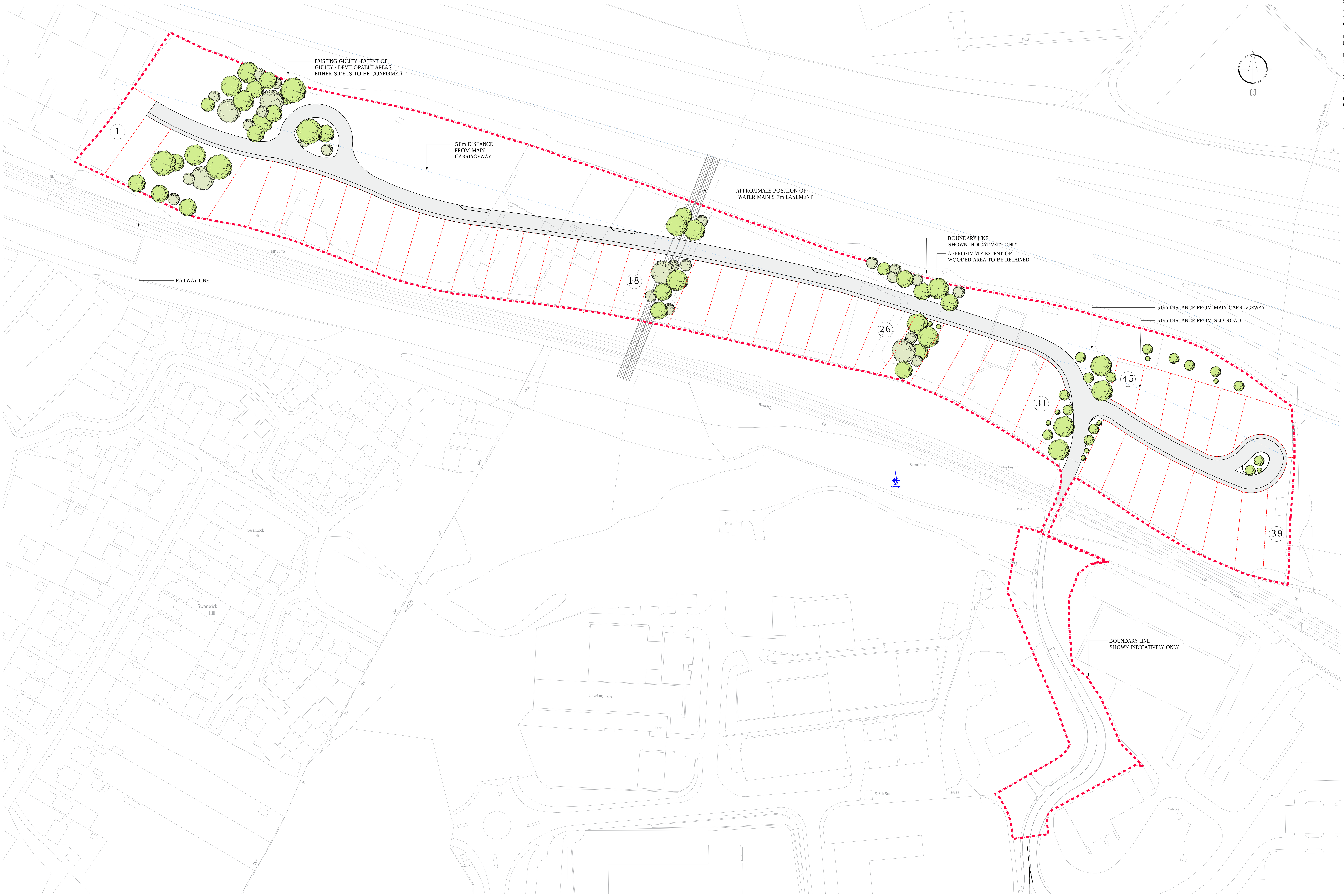
Area provided — $A_{sl\_prov} = \pi \times (16\text{ mm})^2/4 \times 1000\text{ mm/m} / s_l$ = **1340** mm²/m

PASS - The area of longitudinal reinforcement provided is adequate

Transverse crack control steel — **H12 bars at 600mm ctrs**

Design summary

Rigid pavement (CRCP) on Class 1 foundation
30 mm TSCS surface course
200 mm thick reinforced concrete (f_f = 5.0 MPa)
Longitudinal reinforcement - H16 bars at 150 mm ctrs
Transverse reinforcement - H12 bars at 600mm ctrs
200 mm MCHW1 Series 600 capping layer



NOTE:

THIS PLAN IS A CONCEPT LAYOUT PROPOSAL ONLY AND IS SUBJECT TO DETAILED DESIGN DEVELOPMENT AND THE INVOLVEMENT OF OTHER CONSULTANTS INCLUDING STRUCTURAL & CIVIL ENGINEERS.

PROPOSALS ARE SUBJECT TO ALL STATUTORY APPROVALS, INCLUDING PLANNING AND BUILDING CONTROL.

PLOT SIZES ARE INDICATIVE ONLY AT THIS STAGE. PLOT AREAS ARE SUBJECT TO AGREEMENT OF BOUNDARY LOCATIONS.

ALL BOUNDARIES SHOWN ARE INDICATIVE ONLY AND SUBJECT TO VERIFICATION.

THE WATER MAIN POSITION INDICATED ON THE PLAN IS APPROXIMATE ONLY AND SUBJECT TO VERIFICATION AND ITS ACCURATE PLOTTING ON SITE.

TOTAL APPROXIMATE PLOTS: 45

LEGEND

ITEMS CLOUDED WITH A DASHED LINE ARE TO BE CONFIRMED, ARE SUBJECT TO DETAILED DESIGN OR CAN BE EXPECTED TO CHANGE.

REVISION CLOUD HIGHLIGHTING ITEMS CHANGED SINCE PREVIOUS ISSUE OF DRAWING.

SCALE 1:5 mm | SCALE 1:10 mm | SCALE 1:20 mm | SCALE 1:50 m
SCALE 1:100 m | SCALE 1:200 m | SCALE 1:500 m | SCALE 1:1250 m

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CONCEPT SITE LAYOUT OPTION 3

PROPOSED DEVELOPM'T SEGENSWORTH NORTH - WEST LITTLE PARK FARM ROAD FAREHAM HAMPSHIRE

PRELIMINARY ONLY

DRAWING STATUS: PRELIMINARY		
DATE: DEC 2017	DRAWN BY: TW	
SCALE @ A1: 1:1000	CHECKED: GL	DATE CHECKED: DEC 2017
JOB NO. 6504	DRAWING NO. 015	REVISION

REV:	DATE:	DESCRIPTION:	DR	CHK

Segensworth North-West of Fareham: Review of HGV Access

Railton TPC Ltd

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Railton TPC Ltd ref:	NW Fareham 02
Planning Inspectorate	Ref: N/A
Planning Authority	Ref: N/A
Date:	08/12/2016
Author:	Bruce Bamber BSc MA MSc CMILT MCIHT

Table of Contents

1. INTRODUCTION

1.1. This report has been prepared on behalf of Frobisher Developments Ltd to review the access constraints imposed by the railway underbridge that provides access to land lying between the railway and M27 at Segensworth, north-west of Fareham, Hampshire.

1.2. Crouch Waterfall has identified a scheme involving the lowering of the existing carriageway at the underbridge to provide a maximum vehicle height clearance of 4.325m. This height takes into account the width of a standard HGV but does not allow for any safety margin. It is understood that the required safety margin is 75mm. The maximum permitted height of a vehicle would therefore be 4.25m.

1.3. An interim scheme comprising the removal of a wedge of carriageway to provide a consistent clearance through the underbridge will allow a maximum vehicle height clearance of 3.87m, again taking into account the width of a standard HGV. With the allowance for a safety margin the maximum permitted height of a vehicle would be 3.795m.

1.4. The purpose of this report is to assess the proportion of HGVs that would be able to negotiate a bridge with a height of 3.87m and to consider whether there would be merit in providing more height up to the maximum of 4.325m (4.25m plus 0.075m safety margin) if some increase would provide a significant benefit in terms of allowing access by a significant proportion of the fleet that would otherwise be excluded.

1.5. It has been assumed that all data on vehicle heights refers to maximum unladen heights. Vehicles will tend to be lower when laden due to the effects of suspension and this would need to be taken into account when accessing the site.

1.6. There is no regular monitoring of the height of the national vehicle fleet. Vehicles are generally either categorised in terms of their overall weight and numbers of axles (since there are limits set for axle weight) or by overall length. Inventories are made of different categories of vehicle according to engine type/emissions but again there is no logical correlation between engine type and vehicle height. There is therefore no definitive information available as to the overall proportion of the HGV fleet that would be unable to pass under a bridge with a height of 3.87m. This report therefore considers typical heights of a range of vehicle types to provide some understanding of the degree to which the site would be constrained by the 3.87m bridge.

1.7. The author has undertaken observations adjacent to a major A road to provide some additional understanding of the current vehicle categories that are generally more and less than 4m in height.

2. HEIGHT OF HGVS

Legal Position in UK

2.1. There is no legal limit on the height of vehicles in the UK, apart from buses. However, the maximum height of standard HGVs 4.95m since any vehicle with a height in excess of this will find it difficult to negotiate many routes with overbridges. The standard height of a motorway bridge is 5.1m. Any bridge used by road vehicles less than 4.95m is required to carry a sign indicating the minimum clearance available at the bridge.

Examples of Haulage Vehicle Heights

2.2. The following table sets out the heights of a range of HGVs derived from information available on company websites and other sources. Each vehicle is colour coded to indicate whether it would be able to access the 3.87m bridge, the 4.325m bridge or if it would not be able to negotiate either height:

Table 2.1: Example Haulage Vehicle Heights

Company	Vehicle Name/Type	Weight	Height
Eddie Stobart	HT Trailer	28t payload	4.63m
	Chilled variable double deck trailer	24t payload	4.87
	International ET Trailer	28t payload	4.00m
	Fuel Tanker	43,000l capacity	3.31m
	Retail Boxvan Tail Lift Trailer	-	4.23m
	Car Transporter*	8 cars	4.00m
	Chilled FST Fridge Trailer	28t payload	4.09m
	Convertible Double Deck Trailer	28t payload	4.62m
Shipley Transport	18 tonne rigid curtain-sider	18t	4.00m
	26 tonne rigid curtain-sider	26t	4.00m
	44 tonne artic.	44t	4.20m
Hunts Transport	9m curtain sided with tail lift	7.5t	3.50m
	10m curtain sided with tail lift	12t	3.75m
	10m curtain sided with tail lift	18t	4.03
	12m curtain sided with tail lift	26t	3.90m-4.10m
	16.5m curtain sided	44t	4.2m
S&K Haulage (Glamorgan) Ltd	UK standard curtainsiders	28t payload	4.2m
	European standard curtainsiders	28t payload	4.0m
	European standard euroliners	28t payload	4.0m
	Urban curtainsiders with taillift	23t payload	3.84m
	Tailboy curtainsiders	28t payload	4.6m

	General purpose liquid tankers	≤ 28t payload	3.9m
	Temperature controlled trailers	≤ 25t payload	4.0m
	Boxvan trailers	≤ 26t payload	4.0m
Container Transport	Container height 2.59m + 1.45m trailer height		4.04m
	Container height 2.90m + 1.45m trailer height		4.35m
KEY			
(red)	Unable to negotiate either option		
(orange)	Able to negotiate full carriageway lowering scheme only		
(green)	Able to negotiate 'scrape' scheme		

*other car transporters may have maximum loaded height in excess of 4.00m

2.3. It can be seen that almost all haulage HGVs have heights in excess of 3.87m (shown as orange or red). The payload limit for those vehicles that have heights less than 3.87m is around 12 tonnes. Standard transport containers loaded onto an HGV will have a height in excess of 4.0m.

2.4. The Freight Transport Association has stated that 80% of the UK semitrailer fleet has a height of 4.25m or more (http://www.fta.co.uk/export/sites/fta/_galleries/downloads/trailer_height_briefing_note.pdf).

2.5. The author has noted that almost all distribution vehicles used by the large national retailers and haulage companies have heights in excess of 4.0m. There were one or two exceptions but these were a very small minority.

2.6. It is concluded that a height restriction of 3.87m would prevent the vast majority of larger British haulage HGVs from accessing the site. However, a clearance of 4.0m with an additional safety margin would allow the site to be accessible by European standard height haulage HGVs.

Heights of other HGVs

2.7. The following table identifies the heights of a range of other HGVs:

Table 2.2: Other HGV Heights

Vehicle Name/Type	Height
Concrete Mixer (6m3)	3.58m
Concrete Mixer	3.81m
FTA Design Drawbar Vehicle	3.745m
50 tonne truck crane	3.65m

Tower crane	3.25m
Tower crane	4.00m
Grab truck	3.70m
Tipper truck	3.50m
Cherry Picker	3.30m
Refuse vehicle	3.30m – 3.40m
Single deck bus	3.00m
Coach	3.50m
Rigid vans	3.60m (see text below)
Rigid vans (tall)	4.20m (estimate)
Fire appliance	3.40m
Skip loader (small)	3.68m
Skip loader (medium)	3.90m
Skip loader (large)	4.72m
KEY	
	Unable to negotiate either option
	Able to negotiate full carriageway lowering scheme only
	Able to negotiate 'scrape' scheme

Sources: Internet and 'Designing for Deliveries' (FTA, August 1998)

2.8. The table shows that the vast majority of other HGVs would be able to negotiate the lower bridge height of 3.87m. The author has also observed a rigid van/lorry with a height of over 4.0m although the vast majority of rigid vehicles have heights less than 3.87m.

2.9. There appears to be little merit in increasing the height available under the bridge to more than 3.87m to accommodate non-haulage HGVs since very few exceed this height. There also appears to be little merit in reducing the height to less than 3.87m since this would compromise the safety margin available.

2.10. It appears that the majority of construction vehicles would be able to negotiate a bridge with a height of 3.87m although specific equipment such as a large tower crane may be obstructed. Most materials and equipment would be able to pass under the bridge although it is not possible to say, at this stage, whether individual structures or pre-constructed components could be transported to the site.

2.11. It is noted that some tower cranes have a width of around 3.0m. This width would also need to be taken into account when considering the ability to develop the site.

2.12. All service vehicles and emergency vehicles with standard dimensions would be able to pass under the bridge. The author observed a large post office rigid transport vehicle with a height in excess of 4.0m. However, this category of vehicle is unlikely to need to access an employment site.

Other Height Options

2.13. For those vehicle types that are categorised as 'orange' (able to negotiate the higher bridge but unable to negotiate the lower bridge clearance) there is a question as to whether there is a less extreme engineering solution that may provide better value for money than the maximum height option. The following table shows the changes in accessibility achieved through the provision of two additional height options, the first allowing vehicles of 4.00m to pass under the bridge and the second allowing vehicles of 4.15m to pass under the bridge:

Table 2.3: Comparison of Height Options

Vehicle Name/Type	Height	Able to negotiate at height			
		3.795m (3.87m)	4.00m (4.075m)	4.150m (4.225m)	4.250m (4.325m)
HT Trailer	4.63m	N	N	N	N
Chilled variable double deck trailer	4.87	N	N	N	N
International ET Trailer	4.00m	N	Y	Y	Y
Fuel Tanker	3.31m	Y	Y	Y	Y
Retail Boxvan Tail Lift Trailer	4.23m	N	N	N	Y
Car Transporter*	4.00m	N	Y	Y	Y
Chilled FST Fridge Trailer	4.09m	N	N	Y	Y
Convertible Double Deck Trailer	4.62m	N	N	N	N
18 tonne rigid curtain-sider	4.00m	N	Y	Y	Y
26 tonne rigid curtain-sider	4.00m	N	Y	Y	Y
44 tonne artic.	4.20m	N	N	N	Y
9m curtain sided with tail lift	3.50m	Y	Y	Y	Y
10m curtain sided with tail lift	3.75m	Y	Y	Y	Y
10m curtain sided with tail lift	4.03	N	N	Y	Y
12m curtain sided with tail lift	3.90m	N	Y	Y	Y
12m curtain sided with tail lift	4.10m	N	N	Y	Y
16.5m curtain sided	4.2m	N	N	N	Y
UK standard curtainsiders	4.2m	N	N	N	Y
European standard curtainsiders	4.0m	N	Y	Y	Y
European standard euroliners	4.0m	N	Y	Y	Y
Urban curtainsiders with taillift	3.84m	N	Y	Y	Y
Tailboy curtainsiders	4.6m	N	N	N	N
General purpose liquid tankers	3.9m	N	Y	Y	Y
Temperature controlled trailers	4.0m	N	Y	Y	Y

Boxvan trailers	4.0m	N	Y	Y	Y
Container height 2.59m + 1.45m trailer height	4.04m	N	N	Y	Y
Container height 2.90m + 1.45m trailer height	4.35m	N	N	N	N
Concrete Mixer (6m3)	3.58m	Y	Y	Y	Y
Concrete Mixer	3.81m	N	Y	Y	Y
FTA Design Drawbar Vehicle	3.745m	Y	Y	Y	Y
50 tonne truck crane	3.65m	Y	Y	Y	Y
Tower crane	3.25m	Y	Y	Y	Y
Tower crane	4.00m	N	Y	Y	Y
Grab truck	3.70m	Y	Y	Y	Y
Tipper truck	3.50m	Y	Y	Y	Y
Cherry Picker	3.30m	Y	Y	Y	Y
Refuse vehicle	3.40m	Y	Y	Y	Y
Single deck bus	3.00m	Y	Y	Y	Y
Coach	3.50m	Y	Y	Y	Y
Rigid vans	3.60m	Y	Y	Y	Y
Rigid vans (tall)	4.20m	N	N	N	Y
Fire appliance	3.40m	Y	Y	Y	Y
Skip loader (small)	3.68m	Y	Y	Y	Y
Skip loader (medium)	3.90m	N	Y	Y	Y
Skip loader (large)	4.72m	N	N	N	N

*the height does depend on the vehicles being carried although 4.0m is stated as the maximum loaded height for an Eddie Stobart car transporter

2.14. The table confirms that there are certain categories of haulage vehicle, a large container lorry and a large skip loader that will be unable to negotiate any available height.

2.15. An available height of 4.00m allows a number of additional vehicle categories to pass under the bridge compared with the 3.795m available height option (3.87m total height). These include European standard haulage vehicles and curtain-siders, some double deck car transporters, some tankers, some additional boxvan trailers, a large concrete mixer, a larger tower crane (subject to width constraints) and a larger skip loader.

2.16. An available height of 4.15m compared with an available height of 4.00m slightly increases the range of haulage HGVs that can access the site and allows a standard transport container vehicle to access the site.

3. SUMMARY AND CONCLUSION

3.1. It is clear from the information that is available that the site would be unable to accommodate any type of development that attracted large haulage vehicles (B8 warehousing and distribution) if the maximum height available under the bridge were 3.87m. According to Freight Transport Association figures, 80% of the British semitrailer haulage fleet has a height of 4.25m or more. It is concluded that a significant proportion of large haulage HGVs would be unable to access the site even with the maximum ground lowering scheme.

3.2. All standard service and emergency vehicles would be able to negotiate a bridge with a height of 3.87m.

3.3. It appears that most non-haulage HGVs and LGVs have heights less than 3.87m. There are some exceptions to this but in these cases there generally appears to be some flexibility in the choice of vehicle that can be used. For example, some large rigid box vans are in excess of 3.87m in height but other versions with heights less than 3.87m are available that could presumably undertake the same functions.

3.4. On the basis of the above it appears that the site could accommodate a range of industrial types although it should be stressed that any potential occupier would need to be aware of the constraint and would need to assess the likely vehicle fleet that would be associated with the operations on site.

3.5. In terms of construction it appears that most construction vehicles would be able to negotiate the 3.87m bridge although, again, consideration would need to be given to the need to transport large non-divisible components or equipment to and from the site. The width of a tower crane may also constitute a constraint to development since tower cranes in transit exceed the standard HGV width (3.0m compared with a standard HGV width of 2.5m).

3.6. An analysis of the range of heights of HGVs suggests that if the bridge were to provide an effective clearance of 4.00m (4.00m vehicle plus 0.075m safety margin) it would be able to accommodate a number of additional vehicle types including European standard haulage vehicles and curtain-siders, most tankers, some additional boxvan trailers, large concrete mixers, larger tower cranes (subject to width constraints) and larger skip loaders. If the height were to be increased to accommodate vehicles up to 4.15m in height (4.225 total height) the site would become accessible to some additional haulage vehicles and to vehicles carrying standard transport containers (high top containers would be unable to negotiate the bridge in any of the possible circumstances). There is therefore some benefit in increasing the height to accommodate vehicles of 4.00m and a marginal additional benefit it increasing it further to accommodate vehicles up to 4.15m in height.

Comment on the Draft Fareham Local Plan 2036

How to have your say

Complete this form and submit it to the Council by Friday 8 December 2017. Please return to Consultations, Fareham Borough Council, Civic Offices, Fareham PO16 7AZ.

Please provide your contact details at the end of this survey. Doing this will help us to understand where people's views are coming from. Your name and address may be published but it will not be used for any other purposes.

What would you like to comment on?

- [ ] A site allocated for housing
- [X] A site allocated for employment
- [ ] Strategic Policies
- [ ] Housing
- [ ] Employment
- [ ] Retail
- [ ] Community Facilities and Open Space
- [ ] Natural Environment
- [ ] Design
- [ ] Infrastructure (including Transport)
- [ ] Development Allocations (chapter introduction)
- [ ] Implementation and monitoring
- [ ] Other

Please provide the name of the site allocation or policy you want to comment on:

POLICIES E1, E2 AND E3

What do you want to do?

- [ ] Support
- [X] Object
- [ ] Comment

Please provide your comment below:

PLEASE SEE ATTACHED COMMENTS AND APPENDICES

WR4435 DRN ITEM W0813
14-311G-F002(1) HAYLING FARM
14-311G-F003(1) HAYLING FARM
14-311G CALCULATIONS
14-311G DRA HAYLING FARM (3)
14-311G-010-A
14-311G-011-A
14-311G-0112-A
14-311G-013-A

ADVERT JAN 2017
IMAGE 9476
IMAGE 9479
NW FAREHAM REVIEW OF HGV ACCESS

FAREHAM
BOROUGH COUNCIL

Make another comment

What would you like to comment on?

- [ ] A site allocated for housing
- [ ] A site allocated for employment
- [ ] Strategic Policies
- [X] Housing
- [ ] Employment
- [ ] Retail
- [ ] Community Facilities and Open Space
- [ ] Natural Environment
- [ ] Design
- [ ] Infrastructure (including Transport)
- [X] Development Allocations (chapter introduction)
- [ ] Implementation and monitoring
- [ ] Other

Please provide the name of the site allocation or policy you want to comment on:

POLICY DA1

What do you want to do?

Support	Object	Comment
[ ]	[X]	[ ]

Please provide your comment below:

PLEASE SEE ATTACHED COMMENTS WHICH NEED TO BE READ IN THE CONTEXT OF OBJECTIONS TO POLICIES E1, E2, E3 AND ATTACHED CONCEPT SITE LAYOUT 6504-015

Make another comment

What would you like to comment on?

- ☐ A site allocated for housing
- ☐ A site allocated for employment
- ☐ Strategic Policies
- ☐ Housing
- ☐ Employment
- ☐ Retail
- ☐ Community Facilities and Open Space
- ☐ Natural Environment
- ☐ Design
- ☐ Infrastructure (including Transport)
- ☐ Development Allocations (chapter introduction)
- ☐ Implementation and monitoring
- ☐ Other

Please provide the name of the site allocation or policy you want to comment on:

What do you want to do?

Support	Object	Comment
☐	☐	☐

Please provide your comment below:

A bit about you

How to have your say

Please provide your contact details below. Doing this will help us to understand where peoples' views are coming from. Your name and address may be published but it will not be used for any other purposes.

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Thank you for having your say on the Draft Local Plan.

FAREHAM LOCAL PLAN 2036