

Flint Street,
Fartown,
Huddersfield
HD1 6LG

APPROVAL IN PRINCIPLE FOR DESIGN

PRIVATE MASS CONCRETE BURR WALL SUPPORTING HIGHWAY AT 15 RILEY PARK, KIRKBURTON, HUDDERSFIELD, HD8 0SA

Structure reference: K60881
Date: 19-Feb-2019
Revision: C
Status: Final
Prepared by: Jwad Ashraf
Checked by: David Haigh

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA**Structure title:** Private Mass Concrete Burr Wall

Structure Ref. K60881

19th Feb 2019, Rev C

DOCUMENT CONTROL

Structure title: 15 Riley Park, Huddersfield, HD8 0SA**Structure reference:** K60881**Date:** 19/02/2019**Revision:** C**Status:** Final

Document issue record

Issue	Status	Prepared	Date	Checked	Date	Approved	Date
A	Issued	Jwad Ashraf	23-Jan-19	David Haigh	23-Jan-19		
B	Draft	Jwad Ashraf	11-Feb-19	David Haigh	11-Feb-19		
C	Final	Jwad Ashraf	19-Feb-19	David Haigh	19-Feb-19		

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall19th Feb 2019, Rev C

1. HIGHWAY DETAILS

1.1. Type of highway

1.1.1. Location and OS Map / Grid reference

Location: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

OS Map: SE 19627 12620

Grid Ref (X, Y): (419627, 412620)

1.2. Permitted traffic speed

30 Mph

1.3. Existing restrictions

Not Applicable

2. SITE DETAILS

2.1. Obstacles crossed

Not Applicable

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall19th Feb 2019, Rev C

3. PROPOSED STRUCTURE

3.1. Description of structure and design working life

The scheme is to provide additional garden space to the front of the property 15 Riley Park, by removal of the existing slope fill garden landscape.

Due to the removal of the backfill and existing dry stone retaining wall will require the construction of a mass concrete burr wall to support the adjacent public highway, where levels are slightly increased to approximately 1.7m retained height behind the existing dry stone boundary wall. A 400mm retaining wall has been constructed using 7N/mm² 200mm blocks laid flat with 100mm facing block and concrete cavity fill, however this did not meet the highways design standards. It is proposed that this wall will form part of the mass of the concrete. T20 dowel bars will be used at 1.0m ctrs to tie this wall to the new mass. Structural type

Mass concrete gravity burr wall due to strength, ease and speed of construction

3.2. Structural type

Mass concrete gravity wall due to strength, ease and speed of construction

3.3. Foundation type

Mass Concrete Slab due to strength, ease and speed of construction

3.4. Span arrangements

The Retained height of the proposed burr wall supporting the highway will, at its highest point, will be no more than 1.7m high.

In proximity to the supported highway, the length of the burr wall will be approximately 8.0m long. This will ensure support to the public highway at all times.

3.5. Articulation arrangements

The mass of the new concrete burr wall will only be considered to support the highway and will not rely on any other structure for its stability or strength.

Vertical construction joints will be installed at 6.0m centres. A 10mm polystyrene or cork based compression material is to be installed in the construction joint, with a 25mm wide expansion joint along the interfaces with any existing structures.

3.6. Classes and levels

3.6.1. Consequence class

CC2

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall

19th Feb 2019, Rev C

3.6.2. Reliability class

RC2

3.6.3. Inspection level

IL2, Relating to RC2

3.7. Road restraint systems requirements

Vehicular Impact to dry stone wall above. Vehicle restraint system to provide N1 level of containment

3.8. Proposed arrangements for future maintenance and inspection

3.8.1. Traffic management

All works will be undertaken within the boundary of the property therefore no traffic management for the highway will be required.

3.8.2. Arrangements for future maintenance and inspection of structure. Access arrangements to structure.

Access to the site will be by using the existing entrance off Highway Riley Park.

3.9. Environment and sustainability

Not Applicable

3.10. Durability. Materials and finishes

Item	Material	Finish / Location
Gravity Wall & Base	Mass Concrete Grade C25/30	
Wall Masonry	The mass concrete wall will be supported by a skin of masonry 100mm leaf of blockwork to the front face of the burr wall. The masonry will be used as permanent shuttering only and it will not be considered in the design of the wall.	100mm block tied to the mass concrete using Stainless steel wall ties at 5 No per Sqm. The minimum strength of the masonry will be 7.3 N/mm².

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall

19th Feb 2019, Rev C

Item	Material	Finish / Location
Drainage	100mm diameter perforated longitudinal drain behind the wall encased in free draining material and taken to a suitable outlet. 75mm diameter weep holes will be provided at 1.5m centres.	Location of land drain is shown on site plan. The perforated land drain will be taken to a suitable outlet so that it does not discharge onto the adjacent highway.
Waterproofing	Not Applicable to this type of wall construction	
Vehicle Parapet	Unreinforced masonry parapet wall construction	Coursed Stone

3.11. Risks and hazards considered for design, execution, maintenance and demolition. Consultation with and/or agreement from Principal Designer

- Maintenance of vehicular/pedestrian access during construction
- Working at height
- Stability of the adjacent land, structures and the highway
- Existing utility services
- Manual handling of heavy objects
- Pumping of concrete and lean fill mix: spillages onto the highway.

3.12. Estimated cost of proposed structure together with other structural forms considered (including where appropriate proprietary manufactured structure), and the reasons for their rejection (including comparative whole life costs with dates of estimates)

The estimated cost of the proposed structure is excluding/including Statutory Undertakers costs.

£ 6,000 (eight thousand pounds) excluding Statutory Undertakers costs.

3.13. Proposed arrangements for construction

3.13.1. Construction of structure

Refer to 7.3 for details

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall19th Feb 2019, Rev C

3.13.2. Traffic management

It is unlikely that any traffic management along the public highway will be required during the construction of the mass concrete burr wall, other than that of typical material deliveries. The concrete will arrive in a typical concrete delivery vehicle, however a pump or wheelbarrow method should be used to pour the concrete and direct vehicular loading of any kind above the wall until reinforcement works are completed shall not be permitted

If traffic management is required, then it is to be agreed with the Kirklees Council's Highways Service prior to the start of works.

3.13.3. Service diversions

Statutory Service plans to be obtained and presence of services to be confirmed before construction of the new retaining wall is started.

Alternatively, trial hole excavation pits can be undertaken carefully by hand prior to commencement of works to establish location of any services present.

3.13.4. Interface with existing structures

A 25mm polystyrene or cork based compression joint is to be installed along the interfaces with any existing structures (As applicable)

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall19th Feb 2019, Rev C

4. DESIGN CRITERIA

4.1. Actions

4.1.1. Permanent actions

All permanent actions as outlined in BS EN 1991-1-1:2002 and associated National Annex

4.1.2. Snow, Wind and Thermal actions

Snow loading not considered (NA to BS EN 1991-1-3 NA.4.1.1).

Thermal – movement joints specified

Horizontal force due to the wind (in accordance with BS EN 1991-1-4) acting on the fence has been applied at the top of the retaining wall

4.1.3. Actions relating to normal traffic under AW regulations and C&U regulations

20.0 kN/m² minimum surcharge in accordance with BS 8002:2015

4.1.4. Actions relating to General Order traffic under STGO regulations

30.0 kN/m² minimum surcharge in accordance with BS 8002:2015

4.1.5. Footway or footbridge variable actions

A minimum allowance of 5.0kN/m² shall be applied in the garden areas at the top of the wall in accordance with Section 4.5.1.5 (Table 7) of BS 8002:2015 Code of Practice for Earth Retaining Structures.

4.1.6. Actions relating to Special Order traffic, provision for exceptional abnormal indivisible loads including location of vehicle track on deck cross-section

Not Applicable

4.1.7. Accidental actions

Vehicular Impact. Vehicle restraint system is in the form of unreinforced masonry parapet 1.1m high to provide N1 level of containment.

A separate parapet risk assessment calculation in compliance with the DfT “Guidance on the Design, Assessment and Strengthening of Masonry Parapets on Highway Structures” is provided in the structural package HD-A-316-C

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall19th Feb 2019, Rev C

4.1.8. Action during execution

The retaining wall is to be backfilled in accordance with the MCHW and surcharge loadings are to be derived based on the requirements of PD 6694-1:2011. Therefore, compaction pressures imposed on the wall during construction do not need to be considered. (PD 6694-1:2011 CL 7.3.3).

4.1.9. Any special action not covered above

Not Applicable

4.2. Heavy or high load route requirements and arrangements being made to preserve the route, including any provision for future heavier loads or future widening

Not applicable

4.3. Minimum headroom provided

Not applicable

4.4. Authorities consulted and any special conditions required

Kirklees Council

4.5. Standards and documents listed in the Technical Approval Schedule

TAS dated July 2018 - See appendix A.

Additional relevant DoT standards published since the above edition of the TAS including amendments, are listed as follows:

See Appendix

4.6. Proposed Departures relating to departures from standards given in 4.5

Due to the narrow nature of the supported highway and topography of the surrounding area it is highly unlikely that an abnormal loading would be routed through Riley Park. Therefore, a departure from the approved standard, BS8002:2015 is proposed whereby the surcharge loading on the highway has been reduced to 20 kN/m².

4.7. Proposed Departures relating to methods for dealing with aspects not covered by standards in 4.5

The proposed burr wall will be designed and detailed to meet current Highways standards.

The proposed burr wall will be a private wall and as such its maintenance liability will rest with the titleholder of the adjoining land.

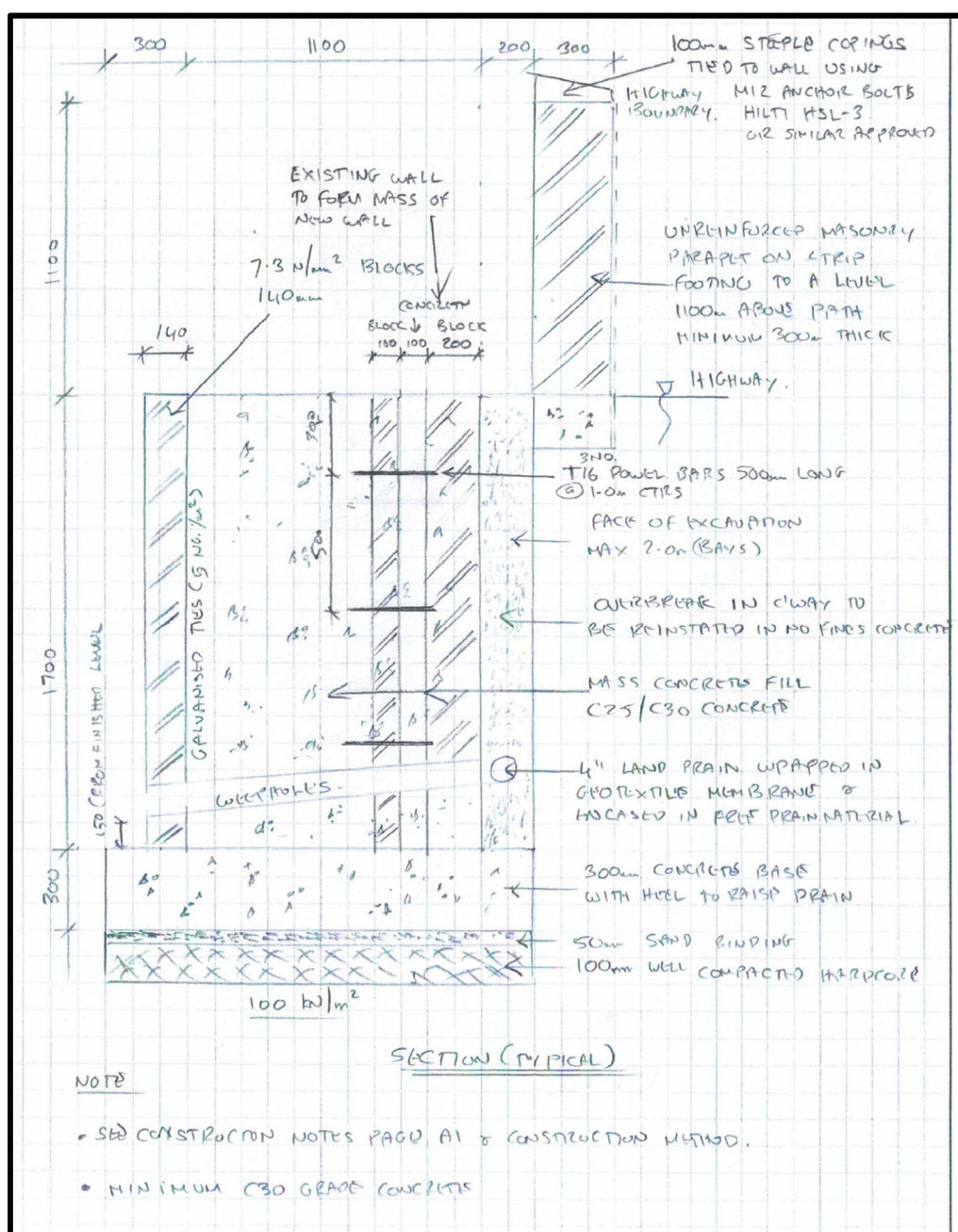
5. STRUCTURAL ANALYSIS

5.1. Methods of analysis proposed for superstructure, substructure and foundations

The design of the mass concrete gravity wall will be in accordance with Eurocode EN1992.

5.2. Description and diagram of idealised structure to be used for analysis

Mass Gravity Wall Structure, typically example as shown below.



Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall19th Feb 2019, Rev C**5.3. Assumptions intended for calculation of structural element stiffness**

Weight of rock behind wall is 17.5 kN/m³.

Surcharge is taken at 20 kN/m² for abnormal loading.

Angle of internal friction of sub strata, $\Phi = 24$ Degrees

Angle of Internal friction of retained soil, $\Phi = 30$ Degrees

Ground bearing pressure of the bedrock sub strata upon which the wall will be constructed = 100 kN/m².

5.4. Proposed range of soil parameters to be used in the design of earth retaining elements

The retaining burr wall has been designed using active pressures, assuming the wall is immobile and with NO passive pressure.

In the global stability conditions, the active pressure, K_a , has been used.

$$K_a = 0.301$$

$$K_o = 0.699$$

6. GEOTECHNICAL CONDITIONS**6.1. Acceptance of recommendations of the Geotechnical Design Report to be used in the design and reasons for any proposed changes**

In the absence of detailed ground investigations, a conservative minimum ground bearing pressure (GBP) of 100 kN/m² has been assumed for the bedrock substrata upon which the wall will be constructed. This will be confirmed on site when excavations have commenced with revisions to the design of the wall undertaken accordingly.

6.2. Summary of design for highway structure in the Geotechnical Design Report

With exception of 6.1 not applicable.

6.3. Differential settlement to be allowed for in the design of the structure

The new gravity wall structure only covers a small area therefore it is considered that differential settlement across the base slab will not occur.

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall19th Feb 2019, Rev C

- 6.4. If the Geotechnical Design Report is not yet available, state when the results are expected and list the sources of information used to justify the preliminary choice of foundations**

With exception of 6.1 not applicable.

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall19th Feb 2019, Rev C

7. CHECK

7.1. Proposed Category and Design Supervision Level

Category 1

7.2. If Category 3, name of proposed Independent Checker

Not Applicable

7.3. Erection proposals or temporary works for which Types S and P Proposals will be required, listing structural parts of the permanent structure affected with reasons

Erect any temporary fencing, barriers and signage to ensure safety of public and workers throughout the construction period.

- 2) Locate all services, by reviewing maps available, but by also undertaking trial holes, excavate by hand to ensure exact location of any services present.
- 3) Due to the close proximity of the proposed retaining structure to the adjoining highway, its construction will be undertaken on a "hit and miss" basis. The new wall will be constructed in maximum 2.0m bays. This will ensure that only a very small section of the highway and the existing boundary wall will be unsupported at any one time. This can be mitigated by installing temporary propping support to the wall, with temporary bollards being installed adjacent to the wall on the highway ensuring that this small section of wall is not subjected to any vehicle surcharge loadings.
- 4) The first bay of the retaining wall, no more than 2.0m wide, will be excavated with the foundation slab being inclined inwards towards the highway.
- 5) The permanent shuttering masonry walls will be constructed, allowing three days before pouring with the mass concrete between the masonry in no more than 300mm lifts at any one time. If temporary support is provided to masonry, then this could allow pouring of concrete in a single operation.
- 6) A minimum of three days must be allowed between pours.
- 7) The top surface of the concrete must be scabbled before pouring of the next layer.
- 8) Upon completion of the structure, the retaining wall must be backfilled with a lean mix concrete.
- 9) The next bay of the retaining wall can then be excavated and constructed, repeating steps 4 to 8.

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall19th Feb 2019, Rev C

8. DRAWINGS AND DOCUMENTS

8.1. List of drawings (including numbers) and documents accompanying the submission

8.1.1. Drawings (See appendix B)

Reference	Title
HD-A-316-RW1 Rev B	Section
HD-A-316-RW2 Rev B	Location Plan
HD-A-316-RW3 Rev B	Site Plan

8.1.2. Documents (See appendix C)

Reference	Title
HD-A-316 Rev B	Structural Calculation Package

Designer to ensure that the latest drawing revisions are included throughout)

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA
Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881
19th Feb 2019, Rev C

9. THE ABOVE IS SUBMITTED FOR ACCEPTANCE

We confirm that details of the temporary works design will be passed to the permanent works Designer for review. [This statement is applicable to temporary works design AIP only]

Signed

REDACTED

Name

Jwad Ashraf

Engineering Qualifications

B. Eng. (Hons) IEng (IMarEST)

Name of Organisation

Hudds Design Ltd

Date

19-Feb-2019

10. THE ABOVE IS REJECTED/AGREED SUBJECT TO THE AMENDMENTS AND CONDITIONS SHOWN BELOW (*)

Signed

REDACTED

Name

Farhad Khatibi

Position held

Principal Engineer (Structures)

Engineering Qualifications

BSc (Hons) Civil Eng, MSc

TAA

Kirklees Council

Date

20/02/2019

For and on behalf of Kirklees Council

(*)

(i) Submission of satisfactory Design and Check Certificate (Category 1) in compliance with the approved AIP Rev C for the design of new private mass concrete burr wall.

(ii) Submission of "Construction Compliance Certificate" in accordance with BD2/12.

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881

19th Feb 2019, Rev C

APPENDIX A

LIST OF RELEVANT DESIGN DOCUMENTS

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall

19th Feb 2019, Rev C

TECHNICAL APPROVAL SCHEDULE (TAS)

Schedule of Documents Relating to Design of Highway Bridges and Structures

(All documents are taken to include revisions current as of 13 July 2018)

The Designer is responsible for ensuring that the standards and references given in the schedule are correct and up to date.

[Tick all the documents used](#) (✓)

Eurocodes and associated UK National Annexes

Used	Reference	Title	Amendment / Corrigenda	
	Eurocode 0	Basis of structural design		
✓	BS EN 1990:2002 +A1:2005	Eurocode 0: Basis of structural design	+A1:2005 Incorporating corrigenda December 2008 and April 2010	See BD100 Annex A for additional guidance.
✓	NA to BS EN 1990:2002 + A1:2005	UK National Annex to Eurocode 0 Basis of structural design	National Amendment No.1	See BD100 Annex A for additional guidance.
	Eurocode 1	Actions on structures		
✓	BS EN 1991-1-1:2002	Eurocode 1: Actions on structures. General Actions. Densities, self-weight, imposed load for buildings	Corrigenda December 2004 and March 2009	
✓	NA to BS EN 1991-1-1:2002	UK National Annex to Eurocode 1: Actions on structures. General Actions. Densities, self-weight, imposed load for buildings	-	
✓	BS EN 1991-1-3:2003 +A1:2015	Eurocode 1: Actions on structures. General Actions. Snow loads	+A1:2015 Incorporating corrigenda December 2004 and March 2009	
✓	NA to BS EN 1991-1-3:2003+A1:2015	UK National Annex to Eurocode 1: Actions on structures. General Actions. Snow loads	+A1:2015 Incorporating corrigendum No.1	
✓	BS EN 1991-1-4:2005 +A1:2010	Eurocode 1: Actions on structures. General Actions. Wind actions	+A1:2010 Corrigenda July 2009 and January 2010	
✓	NA to BS EN 1991-1-4:2005 + A1:2010	UK National Annex to Eurocode 1: Actions on structures. General Actions. Wind actions	National Amendment No.1	
✓	BS EN 1991-1-5:2003	Eurocode 1: Actions on structures. General Actions. Thermal actions	Corrigenda December 2004 and March 2009	
✓	NA to BS EN 1991-1-5:2003	UK National Annex to Eurocode 1: Actions on structures. General Actions. Thermal actions	-	
✓	BS EN 1991-1-6:2005	Eurocode 1: Actions on structures. General Actions. Actions during execution	Corrigenda July 2008, November 2012 and February 2013	
✓	NA to BS EN 1991-1-6:2005	UK National Annex to Eurocode 1: Actions on structures. General Actions. Actions during execution	-	
✓	BS EN 1991-1-7:2006 +A1:2014	Eurocode 1: Actions on structures. General Actions. Accidental actions	+A1: 2014 Corrigendum February 2010	

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA
Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881
 19th Feb 2019, Rev C

Eurocodes and associated UK National Annexes

Used	Reference	Title	Amendment / Corrigenda	
✓	NA+A1 to BS EN 1991-1-7:2006+A1:2014	UK National Annex to Eurocode 1: Actions on structures. Part 1-7 : Accidental actions	+A1:2014 Incorporating corrigenda August 2014 and November 2015	See BD100 for additional guidance.
✓	BS EN 1991-2:2003	Eurocode 1: Actions on structures. Traffic loads on bridges	Corrigenda December 2004 and February 2010	See BD100 Annex A for additional guidance.
✓	NA to BS EN 1991-2:2003	UK National Annex to Eurocode 1: Actions on structures. Traffic loads on bridges	Corrigendum No.1	See BD100 Annex A for additional guidance.
	Eurocode 2	Design of concrete structures		
✓	BS EN 1992-1-1:2004 + A1:2014	Eurocode 2: Design of concrete structures– Part 1-1: General rules and rules for buildings	Incorporating corrigendum January 2008, November 2010 and January 2014	
✓	NA + A2:2014 to BS EN 1992-1-1:2004 + A1:2014	UK National Annex to Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings		
✓	BS EN 1992-2:2005	Eurocode 2: Design of concrete structures – Part 2: Concrete bridges – Design and detailing rules	Corrigendum July 2008	
✓	NA to BS EN 1992-2:2005	UK National Annex to Eurocode 2: Design of concrete structure – Part 2: Concrete bridges – Design and detailing rules	-	
✓	BS EN 1992-3:2006	Eurocode 2: Design of concrete structures – Part 3: Liquid retaining and containment structures	-	
✓	NA to BS EN 1992-3:2006	UK National Annex to Eurocode 2: Design of concrete structure – Part 3: Liquid retaining and containment structures	-	
	Eurocode 3	Design of steel structures		
	BS EN 1993-1-1:2005 + A1:2014	Eurocode 3: Design of steel structures – Part 1-1 General rules and rules for buildings	Corrigenda February 2006 and April 2009	
	NA + A1:2014 to BS EN 1993-1-1:2005 + A1:2014	UK National Annex to Eurocode 3: Design of steel structures – Part 1-1 General rules and rules for buildings	-	
	BS EN 1993-1-3:2006	Eurocode 3: Design of steel structures – Part 1-3 General rules – Supplementary rules for cold-formed members and sheeting	Corrigendum November 2009	
	NA to BS EN 1993-1-3:2006	UK National Annex to Eurocode 3: Design of steel structures – Part 1-3 Supplementary rules for cold-formed members and sheeting	-	
	BS EN 1993-1-4:2006	Eurocode 3: Design of steel structures – Part 1-4 General rules – Supplementary rules for stainless steels	-	
	NA to BS EN 1993-1-4:2006	UK National Annex to Eurocode 3: Design of steel structures – Part 1-4 Supplementary rules for stainless steels	-	
	BS EN 1993-1-5:2006+A1:2017	Eurocode 3: Design of steel structures – Part 1-5 Plated structural elements	Corrigendum April 2009,+A1:2017 Amendment No. 1	
	NA to BS EN 1993-1-5:2006	UK National Annex to Eurocode 3: Design of steel structures – Part 1-5 Plated structural elements	-	

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA
Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881
 19th Feb 2019, Rev C

Eurocodes and associated UK National Annexes				
Used	Reference	Title	Amendment / Corrigenda	
	BS EN 1993-1-6:2007	Eurocode 3: Design of steel structures – Part 1-6 Strength and stability of shell structures	+ A1:2017 Amendment No. 1	
	BS EN 1993-1-7:2007	Eurocode 3: Design of steel structures – Part 1-7 Plated structures subject to out of plane loading	Corrigendum April 2009	
	BS EN 1993-1-8:2005	Eurocode 3: Design of steel structures – Part 1-8 Design of joints	Corrigenda December 2005, September 2006, July 2009 and August 2010	
	NA to BS EN 1993-1-8:2005	UK National Annex to Eurocode 3: Design of steel structures – Part 1-8 Design of joints	-	
	BS EN 1993-1-9:2005	Eurocode 3: Design of steel structures – Part 1-9 Fatigue	Corrigenda December 2005, September 2006 and April 2009	
	NA to BS EN 1993-1-9:2005	UK National Annex to Eurocode 3: Design of steel structures – Part 1-9 Fatigue	-	
	BS EN 1993-1-10:2005	Eurocode 3: Design of steel structures – Part 1-10 Material toughness and through-thickness properties	Corrigenda December 2005, September 2006 and March 2009	
	NA to BS EN 1993-1-10:2005	UK National Annex to Eurocode 3: Design of steel structures – Part 1-10 Material toughness and through thickness properties	-	
	BS EN 1993-1-11:2006	Eurocode 3: Design of steel structures – Part 1-11 Design of structures with tension components	Corrigendum April 2009	
	NA to BS EN 1993-1-11:2006	UK National Annex to Eurocode 3: Design of steel structures – Part 1-11 Design of structures with tension components	-	
	BS EN 1993-1-12:2007	Eurocode 3: Design of steel structures – Part 1-12 Additional rules for the extension of EN 1993 up to steel grades S 700	Corrigendum April 2009	
	NA to BS EN 1993-1-12:2007	UK National Annex to Eurocode 3: Design of steel structures – Part 1-12 Additional rules for the extension of EN 1993 up to steel grades S 700	-	
	BS EN 1993-2:2006	Eurocode 3: Design of steel structures – Part 2 Steel bridges	Corrigendum July 2009	
	NA + A1:2012 to BS EN 1993-2:2006	UK National Annex to Eurocode 3: Design of steel structures – Part 2 Steel bridges	+ A1:2012	
	BS EN 1993-5:2007	Eurocode 3: Design of steel structures – Part 5 Piling	Corrigendum May 2009	
	NA + A1:2012 to BS EN 1993-5:2007	UK National Annex to Eurocode 3: Design of steel structures – Part 5 Piling	+ A1:2012	
	Eurocode 4	Design of composite steel and concrete structures		
	BS EN 1994-1-1:2004	Eurocode 4: Design of composite steel and concrete structures – Part 1-1 General rules and rules for buildings	Corrigendum April 2009	
	NA to BS EN 1994-1-1:2004	UK National Annex to Eurocode 4: Design of composite steel and concrete structures – Part 1-1 General rules and rules for buildings	-	
	BS EN 1994-2:2005	Eurocode 4: Design of composite steel and concrete structures – Part 2 General rules and rules for bridges	Corrigendum July 2008	

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA
Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881
 19th Feb 2019, Rev C

Eurocodes and associated UK National Annexes				
Used	Reference	Title	Amendment / Corrigenda	
	NA to BS EN 1994-2:2005	UK National Annex to Eurocode 4: Design of composite steel and concrete structures – Part 2 General rules and rules for bridges	-	
	Eurocode 5	Design of timber structures		
	BS EN 1995-1-1:2004 + A2:2014	Eurocode 5: Design of timber structures – Part 1-1 General – common rules and rules for buildings	+ A2:2014 Incorporating corrigendum June 2006	
	NA to BS EN 1995-1-1:2004 + A1:2008	UK National Annex to Eurocode 5: Design of timber structures – Part 1-1 General – common rules and rules for buildings	+ A1:2008 Incorporating National Amendment No. 2	
	BS EN 1995-2:2004	Eurocode 5: Design of timber structures – Part 2 Bridges	-	
	NA to BS EN 1995-2:2004	UK National Annex to Eurocode 5: Design of timber structures – Part 2 Bridges	-	
	Eurocode 6	Design of masonry structures		
	BS EN 1996-1-1:2005	Eurocode 6: Design of masonry structures – Part 1-1 General rules for reinforced and unreinforced masonry structures	Corrigenda February 2006 and July 2009	
	NA to BS EN 1996-1-1:2005 + A1:2012	UK National Annex to Eurocode 6: Design of masonry structures – Part 1-1 General rules for reinforced and unreinforced masonry structures	Corrigendum October 2015	
	BS EN 1996-2:2006	Eurocode 6: Design of masonry structures – Part 2 Design considerations, selection of materials and execution of masonry	Corrigendum September 2009	
	NA to BS EN 1996-2:2006	UK National Annex to Eurocode 6: Design of masonry structures – Part 2 Design considerations, selection of materials and execution of masonry	Corrigendum No.1	
	BS EN 1996-3:2006	Eurocode 6: Design of masonry structures – Part 3 Simplified calculation methods for unreinforced masonry structures	Corrigendum October 2009	
	NA + A1:2014 to BS EN 1996-3:2006	UK National Annex to Eurocode 6: Design of masonry structures – Part 3 Simplified calculation methods for unreinforced masonry structures	+A1:2014	
	Eurocode 7	Geotechnical design		
✓	BS EN 1997-1:2004+A1:2013	Eurocode 7: Geotechnical design – Part 1 General rules	+A1:2013 Corrigendum February 2009	
✓	NA+A1 to BS EN 1997-1:2004+A1:2013	UK National Annex to Eurocode 7: Geotechnical design – Part 1 General rules	+A1:2013 Incorporating Corrigendum No.1	
✓	BS EN 1997-2:2007	Eurocode 7: Geotechnical design – Part 2 Ground investigation and testing	Corrigendum June 2010	
✓	NA to BS EN 1997-2:2007	UK National Annex to Eurocode 7: Geotechnical design – Part 2 Ground investigation and testing	-	
	Eurocode 8	Design of structures for earthquake resistance		
	BS EN 1998-1:2004 + A1:2013	Eurocode 8: Design of structures for earthquake resistance – Part 1 General rules, seismic actions and rules for buildings	Corrigendum June 2009, January 2011 and March 2013	

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA
Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881
 19th Feb 2019, Rev C

Eurocodes and associated UK National Annexes				
Used	Reference	Title	Amendment / Corrigenda	
	NA to BS EN 1998-1:2004	UK National Annex to Eurocode 8: Design of structures for earthquake resistance – Part 1 General rules, seismic actions and rules for buildings	-	
	BS EN 1998-2:2005+A2:2011	Eurocode 8: Design of structures for earthquake resistance – Part 2 Bridges	Corrigenda February 2010 and February 2012	
	NA to BS EN 1998-2:2005	UK National Annex to Eurocode 8: Design of structures for earthquake resistance – Part 2 Bridges	-	
	BS EN 1998-5:2004	Eurocode 8: Design of structures for earthquake resistance – Part 5 Foundations, retaining structures and geotechnical aspects	-	
	NA to BS EN 1998-5:2004	UK National Annex to Eurocode 8: Design of structures for earthquake resistance – Part 5 Foundations, retaining structures and geotechnical aspects	-	
	Eurocode 9	Design of aluminium structures		
	BS EN 1999-1-1:2007 + A2:2013	Eurocode 9: Design of aluminium structures – Part 1-1 General structural rules	+ A2:2013 Incorporating corrigendum March 2014	
	NA to BS EN 1999-1-1:2007 + A1:2009	UK National Annex to Eurocode 9: Design of aluminium structures – Part 1-1 General structural rules	National Amendment No.1 Corrigendum No.1	
	BS EN 1999-1-3:2007 + A1:2011	Eurocode 9: Design of aluminium structures – Part 1-3 Structures susceptible to fatigue	+ A1:2011	
	NA to BS EN 1999-1-3:2007 + A1:2011	UK National Annex to Eurocode 9: Design of aluminium structures – Part 1-3 Structures susceptible to fatigue	+ A1:2011	
	BS EN 1999-1-4:2007 +A1:2011	Eurocode 9: Design of aluminium structures – Part 1-4 Cold formed structural sheeting	+ A1:2011 Corrigendum November 2009	
	NA to BS EN 1999-1-4:2007	UK National Annex to Eurocode 9: Design of aluminium structures – Part 1-4 Cold formed structural sheeting	-	

BSI Published Documents			
Used	Reference	Title	
For guidance only unless clauses are otherwise specified in BD 100/16 Annex B.			
	PD 6688-1-1:2011	Recommendations for the design of structures to BS EN 1991-1-1	See BD100 Annex B for additional guidance.
	PD 6688-1-4:2015	Background paper to the UK National Annex to BS EN 1991-1-4	See BD100 Annex B for additional guidance.
	PD 6688-1-7:2009 +A1:2014	Recommendations for the design of structures to BS EN 1991-1-7	See BD100 clause 2.17 and Annex B for additional guidance.
	PD 6688-2:2011	Recommendations for the design of structures to BS EN 1991-2	See BD100 Annex B for additional guidance.
	PD 6687-1:2010	Background paper to the UK National Annexes to BS EN 1992-1 and BS EN 1992-3	See BD100 clauses 2.15, 2.16 and Annex B for additional guidance.

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA
Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881
 19th Feb 2019, Rev C

BSI Published Documents

Used	Reference	Title	
	PD 6687-2:2008	Recommendations for the design of structures to BS EN 1992-2:2005	See BD100 clause 2.16 and Annex B for additional guidance.
	PD 6695-1-9:2008	Recommendations for the design of structures to BS EN 1993-1-9	See BD100 Annex B for additional guidance.
	PD 6695-1-10:2009	Recommendations for the design of structures to BS EN 1993-1-10	See BD100 Annex B for additional guidance.
	PD 6695-2:2008 + A1:2012 Incorporating Corrigendum No.1	Recommendation for the design of bridges to BS EN 1993	See BD100 Annex B for additional guidance.
	PD 6696-2:2007 + A1:2012	Background paper to BS EN 1994-2 and the UK National Annex to BS EN 1994-2	See BD100 Annex B for additional guidance.
	PD 6694-1:2011	Recommendations for the design of structures subject to traffic loading to BS EN 1997-1	See BD100 Annex B for additional guidance.
	PD 6698:2009	Recommendations for the design of structures for earthquake resistance to BS EN 1998	See BD100 Annex A for additional guidance.
	PD 6703:2009	Structural bearings – Guidance on the use of structural bearings	
	PD 6705-2:2010 + A1:2013	Recommendations for the execution of steel bridges to BS EN 1090-2	Amended 30 April 2013
	PD 6705-3:2009	Recommendations on the execution of aluminium structures to BS EN 1090-3	
	PD 6702-1:2009	Structural use of aluminium. Recommendations for the design of aluminium structures to BS EN 1999	

Execution Standards referenced in British Standards or Eurocodes

Used	Reference	Title	
	BS EN 1090-1:2009+A1:2011	Execution of steel structures and aluminium structures - Part 1: Requirements for conformity assessment of structural components	
	BS EN 1090-2:2018	Execution of steel structures and aluminium structures. Technical requirements for the execution of steel structures	Supersedes BS EN 1090-2:2008+A1:2011
	BS EN 1090-3:2008	Execution of steel structures and aluminium structures – Part 3: Technical requirements for aluminium structures	
	BS EN 13670:2009 Incorporating corrigenda October 2015 and November 2015	Execution of concrete structures	

Product Standards referenced in British Standards or Eurocodes

Used	Reference	Title	
	BS EN 206:2013	Concrete – Specification, performance, production and conformity	Corrigendum May 2014
	BS EN 1317-1:2010	Road Restraint Systems – Part 1 – Terminology and general criteria for test methods	
	BS EN 1317-2:2010	Road Restraint Systems – Part 2 – Performance classes, impact test acceptance criteria and test methods for safety barriers.	
	BS EN 1317-3:2010	Road Restraint Systems – Part 3 – Performance classes, impact test acceptance criteria and test methods for crash cushions.	

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA
Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881
 19th Feb 2019, Rev C

Product Standards referenced in British Standards or Eurocodes

Used	Reference	Title	
	DD ENV 1317-4:2002	Road Restraint Systems – Part 4 – Performance classes, impact test acceptance criteria and test methods for terminals and transitions of safety barriers.	<i>Draft BS EN 1317-4 for public comment published in June 2012</i>
	BS EN 1317-5:2007+A2:2012	Road Restraint Systems – Part 5 - Product requirements and evaluation of conformity for vehicle restraint systems	<i>Incorporating corrigendum August 2012 Draft prEN 1317-5 for public comment published in December 2013</i>
	PD CEN/TR 16949:2016	Road Restraint System – Pedestrian restraint system - Pedestrian parapets	<i>Bsi Published Document / CEN Technical Report published in July 2016 (This document should temporarily not be used. The requirements of BS 7818:2015 apply.)</i>
	Draft prEN 1317-7	Road restraint systems - Part 7: Performance classes, impact test acceptance criteria and test methods for terminals of safety barriers	<i>Draft prEN 1317-7 for public comment published in June 2012</i>
	PD CEN/TS 1317-8:2012	Road restraint systems - Part 8: Motorcycle road restraint systems which reduce the impact severity of motorcyclist collisions with safety barriers	<i>Bsi Published Document / CEN Technical Specification published in May 2012</i>
	BS EN 1337-1:2000	Structural bearings – Part 1: General Design Rules	
	BS EN 1337-2:2004	Structural bearings – Part 2: Sliding elements	
	BS EN 1337-3:2005	Structural bearings – Part 3: Elastomeric bearings	
	BS EN 1337-4:2004	Structural bearings – Part 4: Roller bearings	
	BS EN 1337-5:2005	Structural bearings – Part 5: Pot bearings	
	BS EN 1337-6:2004	Structural bearings – Part 6: Rocker bearings	
	BS EN 1337-7:2004	Structural bearings – Part 7: Spherical and cylindrical PTFE bearings	
	BS EN 1337-8:2007	Structural bearings – Part 8: Guide bearings and restraint bearings	
	BS EN 1337-9:1998	Structural bearings – Part 9: Protection	
	BS EN 1337-10:2003	Structural bearings – Part 10: Inspection and maintenance	
	BS EN 1337-11:1998	Structural bearings – Part 11: Transport, Storage and Installation.	
	BS EN 1794-1:2018	Road traffic noise reducing devices – Non-acoustic performance Part 1: Mechanical performance and requirements	Supersedes previous version BS EN 1794-1:2011
	BS EN 1794-2:2011	Road traffic noise reducing devices – Non-acoustic performance Part 2: General safety and environmental requirements	
	BS EN 10025-1:2004	Hot rolled products of structural steels Part 1: General technical delivery conditions.	
	BS EN 10025-2:2004	Hot rolled products of structural steels Part 2: Technical delivery conditions for non-alloy structural steels.	
	BS EN 10025-3:2004	Hot rolled products of structural steels Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels.	
	BS EN 10025-4:2004	Hot rolled products of structural steels Part 4: Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels.	

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure Ref. K60881

Structure title: Private Mass Concrete Burr Wall

19th Feb 2019, Rev C
Product Standards referenced in British Standards or Eurocodes

Used	Reference	Title	
	BS EN 10025-5:2004	Hot rolled products of structural steels – Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance	
	BS EN 10025-6:2004+A1:2009	Hot rolled products of structural steels – Part 6: Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition.	
	BS EN 10080:2005	Steel for the reinforcement of concrete – Weldable reinforcing steel - General	
	BS EN 10210-1:2006	Hot finished structural hollow sections of non-alloy and fine grain steels – Part 1: Technical delivery conditions	
	BS EN 10210-2:2006	Hot finished structural hollow sections of non-alloy and fine grain steels – Part 2: Tolerances, dimensions and sectional properties	<i>Incorporating corrigendum no.1</i>
	BS EN 10248-1:1996	Hot rolled sheet piling of non alloy steels. Technical delivery conditions	
	BS EN 10248-2:1996	Hot rolled sheet piling of non alloy steels. Tolerances on shape and dimensions	
	BS EN 12063:1999	Execution of special geotechnical work. Sheet pile walls.	
	BS EN 15050:2007 + A1:2012	Precast concrete products – Bridge elements	See BD100 clause 2.18 for additional guidance.

British Standards

Used	Reference	Title	
	BS 4449:2005 + A3:2016	Steel for the reinforcement of concrete	No longer covers plain round bar. (See BS4482 up to 12mm dia, see BS EN 10025-1 for larger sizes and dowels. See BS EN 13877-3 for dowel bars in concrete pavements.)
	BS 5896:2012	Specification for high tensile steel wire and strand for the prestressing of concrete	
	BS 7818:1995	Specification for pedestrian restraint systems in metal	Currently the requirements of BS 7818:2015 are to be used instead of PD CEN/TR 16949:2016
✓	BS 8002:2015	Code of practice for earth retaining structures	
✓	BS 8004:2015	Code of practice for foundations	
	BS 8006-1:2010 + A1:2016	Code of practice for strengthened/reinforced soils and other fills	
✓	BS 8500-1:2015 + A1:2016	Concrete – Complementary British Standard to BS EN 206 : Method of specifying and guidance for the specifier.	Incorporating Corrigendum No.1
✓	BS 8500-2:2015 + A1:2016	Concrete – Complementary British Standard to BS EN 206 : Specification for constituent materials and concrete.	
	BS 8666:2005	Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete	Incorporating Amendment No.1

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA
Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881
 19th Feb 2019, Rev C

The Manual Contract Document for Highway Works (MCHW)

Used	Reference	Title	
✓	MCHW Volume 1: May 2017	Specification for Highway Works	<i>Specification compliant with the execution standards must be used. A Departure is necessary for the parts where a compliant revision has not been published.</i>
✓	MCHW Volume 2: May 2017	Notes for guidance on the Specification for Highway Works	<i>Notes for guidance compliant with the execution standards must be used. A Departure is necessary for the parts where a compliant revision has not been published.</i>
✓	MCHW Volume 3: February 2017	Highway Construction Details	

The Design Manual for Roads and Bridges (DMRB)

Used	Reference	Title	
✓	BD 2/12	Technical Approval of Highway Structures	
	BD 7/01	Weathering steel for highway structures	<i>See IAN 124/11 Annex C for additional guidance.</i>
	BD 10/97	Design of highway structures in areas of mining subsidence	<i>See IAN 124/11 Annex C for additional guidance.</i>
	BD 12/01	Design of corrugated steel buried structures with spans greater than 0.9 metres and up to 8.0 metres	<i>See IAN 124/11 Annex C for additional guidance.</i>
	BD 29/17	Design criteria for footbridges	
	BD 33/94	Expansion joints for use in highway bridge decks	<i>See IAN 124/11 Annex C for additional guidance.</i>
	BD 35/14	Quality assurance scheme for paints and similar protective coatings	
	BD 36/92	Evaluation of maintenance costs in comparing alternative designs for highway structures	
	BD 43/03	The impregnation of reinforced and prestressed concrete highway structures using hydrophobic pore-lining impregnants	
	BD 45/93	Identification markings of highway structures	
	BD 47/99	Waterproofing and surfacing of concrete bridge decks	<i>See IAN 124/11 Annex C for additional guidance.</i>
	BD 51/14	Portal and cantilever signs/signal gantries	
	BD 57/01	Design for durability	<i>Not to be used. See IAN 124/11 Annex C for additional guidance.</i>
	BD 62/07	As built, operational and maintenance records for highway structures	<i>See IAN 124/11 Annex C for additional guidance.</i>
	BD 65/14	Design criteria for collision protection beams	
	BD 67/96	Enclosure of bridges	<i>See IAN 124/11 Annex C for additional guidance.</i>
	BD 68/97	Crib retaining walls	Withdrawn
	BD 78/99	Design of road tunnels	<i>See IAN 124/11 Annex C for additional guidance.</i>

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881

19th Feb 2019, Rev C

The Design Manual for Roads and Bridges (DMRB)

Used	Reference	Title	
	BD 82/00	Design of buried rigid pipes	Withdrawn
	BD 90/05	Design of FRP bridges and highway structures	
	BD 94/17	Design of minor structures	
	BD 100/16	The use of Eurocodes for the design of highway structures	
	BA 26/94	Expansion joints for use in highway bridge decks	<i>See IAN 124/11 Annex C for additional guidance.</i>
	BA 28/92	Evaluation of maintenance costs in comparing alternative designs for highway structures	
	BA 36/90	The use of permanent formwork	<i>Not to be used. See IAN 124/11 Annex C for additional guidance.</i>
	BA 41/98	The design and appearance of bridges	
	BA 42/96	The design of integral bridges	<i>Not to be used. See IAN 124/11 Annex C for additional guidance.</i>
	BA 47/99	Waterproofing and surfacing of concrete bridge decks	<i>See IAN 124/11 Annex C for additional guidance.</i>
	BA 57/01	Design for durability	<i>Not to be used. See IAN 124/11 Annex C for additional guidance.</i>
	BA 59/94	Design of highway bridges for hydraulic action.	<i>Not to be used. See IAN 124/11 Annex C for additional guidance.</i>
	BA 67/96	Enclosure of bridges	<i>See IAN 124/11 Annex C for additional guidance.</i>
	BA 68/97	Crib retaining walls	
	BA 82/00	Formation of continuity joints in bridge decks	
	BA 85/04	Coatings for concrete highway structures & ancillary structures	
	BA 92/07	Use of recycled concrete aggregates in structural concrete	
	TD 19/06	Requirement for road restraint systems	<i>See IAN 124/11 Annex C for additional guidance.</i>
	TD 27/05	Cross-sections and headrooms	<i>See IAN 124/11 Annex C for additional guidance.</i>
	HD 22/08	Managing geotechnical risk	
	HA 66/95	Environmental barriers	<i>See IAN 124/11 Annex C for additional guidance. Work on update being undertaken.</i>
	GD 01/15	Introduction to the Design Manual for Roads and Bridges	
	GD 02/16	Quality Management Systems for Highway Design	
	GD 04/12	Standard for Safety Risk Assessment on the Strategic Road Network	

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA
Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881
 19th Feb 2019, Rev C

Interim Advice Notes

Used	Reference	Title
	IAN 69/15	Designing for maintenance
	IAN 83/06	Principal and General Inspection of Sign/Signal Gantries, and Gantries with low handrails or open mesh flooring
	IAN 96/07r1	Guidance on implementing results of research on bridge deck waterproofing.
	IAN 97/07	Assessment and upgrading of existing parapets
	IAN 104/15	The anchorage of reinforcement and fixings in hardened concrete.
	IAN 105/08	Implementation of construction (design and management) 2007 and the withdrawal of SD 10 and SD 11
	IAN 117/08r2	Certification of combined kerb and drainage products
	IAN 124/11 Annex C	Use of Eurocodes for the design of highway structures
	IAN 127/10r1	The use of foamed concrete
	IAN 131/11	Deflection of Permanent Formwork
	IAN 136/10	Structural safety reporting
	IAN 149/17	Existing Motorway Minimum Requirements
	IAN 161/15	Smart Motorways
	IAN 177/13	Introduction of the Construction Products Regulation (EU) 305/2011
	IAN 184/16	Highways Agency Data & CAD Standard
	IAN 186/15	In-situ concrete barriers based on proprietary designs commercialised as products
	IAN 193/16	Requirements for the provision of access arrangements on gantries

Miscellaneous

Used	Reference	Title	
	CHE Memorandum 227/08	The Impregnation of Reinforced and Prestressed Concrete Highway Structures using Hydrophobic Pore Lining Impregnants	CHE memoranda are internal Highways England documents and not available to external organisations. This CHE memorandum is included as a useful reference for the Technical Approval Authority.
	CIRIA C543	Bridge Detailing Guide	
	CIRIA C656	Masonry arch bridges: condition, appraisal and remedial treatment	
	CIRIA C660	Early-age Thermal Crack Control in Concrete	
	CIRIA C676	Drystone retaining walls and their modifications: condition appraisal and remedial treatment	
	CIRIA C686	Safe Access for Maintenance and Repair	
	CIRIA C760	Guidance on embedded retaining wall design	
	DfT UK Roads liaison group	Provision of Road Restraint systems on Local Highway Authority Roads	October 2011

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881

19th Feb 2019, Rev C

APPENDIX B

DRAWINGS

Scheme title: 15 Riley Park, Kirkburton, Huddersfield, HD8 0SA

Structure title: Private Mass Concrete Burr Wall

Structure Ref. K60881

19th Feb 2019, Rev C

APPENDIX C

ADDITIONAL INFORMATION