Design Manual for Roads and Bridges

Geotechnics
Design

CD 622
Managing geotechnical risk

(formerly HD 22/08, BD 10/97, HA 120/08)

Revision 1

Summary
This document defines the technical approval and certification procedures to be used to ensure that the risks associated with geotechnical activities are appropriately managed.

Application by Overseeing Organisations
Any specific requirements for Overseeing Organisations alternative or supplementary to those given in this document are given in National Application Annexes to this document.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated Highways England team. The email address for all enquiries and feedback is: Standards_Enquiries@highwaysengland.co.uk

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Release notes

Version	Date	Details of amendments
1	Mar 2020	Revision 1 (March 2020) Update to references and revised Scotland National Application Annex. Revision 0 (August 2019) CD 622 replaces HD 22/08, BD 10/97 and HA 120/08. The philosophy of the original document remains the same but the full document has been re-written to make it compliant with the new Highways England drafting rules.

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Foreword

Publishing information

This document is published by Highways England.

This document supersedes HD 22/08, BD 10/97 and HA 120/08, which are withdrawn.

Relationship with other publications

This document contains references to other documents of the DMRB, British Standards, Eurocodes, Transport Scotland, Welsh Government and CIRIA documents.

Contractual and legal considerations

This document does not purport to include all the necessary provisions of a contract. Users are responsible for applying all appropriate documents applicable to their contract.

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Introduction

Background

An essential part of the project lifecycle is the identification and management of risks, and all parties have a role in ensuring that risks are identified and avoided or reduced to tolerable levels. Ground conditions are often uncertain and present risks which have to be managed proactively. Cost overrun was the main risk that the forerunner of this DMRB document set out to overcome in 1992. However, ground related risks continue to affect and influence many aspects of highway construction, operation and management. A revised DMRB document issued in 2002 introduced formal geotechnical risk management and followed the guidance given in BS EN 1997 [Ref 2.N]. The 2008 revision further simplified and improved the process with the reporting being aligned to reflect the requirements of BS EN 1997 [Ref 2.N]. This version has maintained the essential requirements of the 2008 document but has condensed the text, added the opportunity to adopt a more flexible report format (by agreement for each project), renamed the Annex A as the ground investigation scope report and renamed the strengthened earthwork appraisal form as the special geotechnical measures form.

In Scotland, for road projects promoted by the Trunk Road Authority, the principles of this document are to be adopted, but differing organisational structures mean that separate certification and checking requirements are in place. See the Scotland National Application Annex for further details.

Assumptions made in the preparation of this document

The assumptions made in GG 101 [Ref 6.N] apply to this document.

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Abbreviations

Abbreviations

Abbreviation	Definition
AGS	Association of Geotechnical and Geoenvironmental Specialists
CV	Curriculum vitae
DGA	Designer's Geotechnical Advisor
EqIA	Equality Impact Assessment
GDR	Geotechnical Design Report
GIR	Ground Investigation Report
GISR	Ground Investigation Scope Report
GFR	Geotechnical Feedback Report
ICC	Independent Checking Consultant
OO	Overseeing Organisation
OO Reference No.	Unique report number for use in the OO geotechnical asset management system
OOGA	Overseeing Organisation's Geotechnical Advisor
PSSR	Preliminary Sources Study Report (including the desk study and site reconnaissance described in BS 5930 [Ref 1.N])
RoGEP	Register of Ground Engineering Professionals
SGM	Special geotechnical measures
SGMF	Special Geotechnical Measures Form
SHW	Specification for Highway Works (Highways England)
SoI	Statement of Intent (report)

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Terms and definitions

Terms

Term	Definition
AGS file	A standard data file format defined by the Association of Geotechnical and Geoenvironmental Specialists.
Designer	The organisation employed to carry out the design of the works.
Earthworks	Engineering works that have been constructed using soil and/or rock involving change in elevation of the ground level.
Factual report	A report that presents the findings of physical ground investigation work and associated laboratory testing.
Geotechnical activity	To include the design, construction and maintenance of: 1) earthworks; 2) special geotechnical measures; 3) ground investigations, both intrusive and non-intrusive; 4) excavation/assessment below carriageway construction level; 5) earth retaining structures; 6) structural foundations and excavations; 7) tunnelling; 8) trenchless crossings; 9) excavations for services on/or adjacent to earthworks and/or natural slopes, including drains, electricity and communications cables (includes OO and third party services); 10) ground treatment.
Geotechnical Advisor	A Chartered Engineering Geologist or Geotechnical Engineer, with experience as defined in clause 2.12.
Geotechnical asset	The man-made or natural earthworks and geotechnical structures below the road pavement layers, highways structures and the adjacent land within the OO boundary.
Geotechnical Certificate	A document to certify the reports required by the geotechnical risk management process.
Geotechnical risk	The risk to the OO's asset or the project, the public, environment, construction and operational activities created by the site ground conditions.
Geotechnical Risk Register	The essential tool for documenting risks and actions to manage each risk and used to drive the geotechnical risk management process.
Hazard	An object, feature, event or activity that has the potential to have adverse effects or undesirable consequences.
Intrusive and non-intrusive works	Intrusive works involve breaking the ground surface, for example boreholes, excavations.Non-intrusive works involve geophysical methods to obtain data without breaking the ground surface.

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Terms (continued)

Term	Definition
Independent checking consultant	A geotechnical consultant employed by the Overseeing Organisation to carry out an independent check of aspects of the geotechnical design.
Overseeing Organisation	Highways England or the highways or roads authorities or the devolved administrations of Scotland, Wales and Northern Ireland, and their successors.
Risk	A measure of the likelihood of a hazard occurring and the resulting possible consequences.
Special geotechnical measures	Techniques that: 1) enable a soil or rock to permanently stand at an angle greater than achievable by simple earthworks (for example the inclusion of tensile reinforcement, soil nailing, chemical additives or external support such as gabions); 2) mitigate a pre-existing geotechnical hazard; 3) remediate a post-construction defect. 4) the term allows the identification of such areas in asset data systems.
Third party	Any person, organisation or other legal entity that is not employed directly or indirectly by the Overseeing Organisation.

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1. Scope

Aspects covered

1.1 This DMRB document shall be used to define the procedures, documentation and certification for all works undertaken on Overseeing Organisation (OO) highways projects and third party works that impact the OO's geotechnical asset.

NOTE 1 *In Scotland, for road projects promoted by the Trunk Road Authority, differing organisational structures mean that separate certification and checking requirements are currently being retained. Please refer to the Scotland National Application Annex and Transport Scotland.*

NOTE 2 *In Wales the certification and checking requirements are augmented by the advice document 'Managing geotechnical risk. Implementation guidance - Wales' MGRG (W) [Ref 3.I].*

Implementation

1.2 This document shall be implemented forthwith on all schemes involving geotechnical activities on the OO's motorway and all-purpose trunk roads according to the implementation requirements of GG 101 [Ref 6.N].

Use of GG 101

1.3 The requirements contained in GG 101 [Ref 6.N] shall be followed in respect of activities covered by this document.

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2. General requirements

2.1 This DMRB document shall be used to provide a clear and consistent record of the management of geotechnical risks to the highways asset at all stages in a project (options, development, construction and removal).

2.2 The record shall be passed forward for operation and ultimately removal of the asset.

2.3 Reporting and certification shall be provided at each stage of the project as required by the OOGA to provide an auditable record.

2.4 If the method of procurement or designer is changed during a scheme then any concerns about the adequacy of the geotechnical information previously produced and certified shall be raised with the OO at changeover.

2.5 This DMRB document shall be applied to all geotechnical works that can impact on the OO's asset, including the OO's and third party works.

2.6 Any areas outside the current OO's asset that fall within the scope or impact of the project shall also be included in geotechnical studies.

2.7 Two key personnel shall be appointed to manage the geotechnical risk, namely the Designer's Geotechnical Advisor (DGA) and the Overseeing Organisation's Geotechnical Advisor (OOGA).

2.8 Where geotechnical submissions are produced within an OO the DGA shall be separate to the OOGA.

2.9 The curriculum vitae (CV) for the individual to be appointed as DGA shall demonstrate the qualifications and experience to meet the requirements in Cl. 2.12.

2.10 The CV of the DGA shall be subject to approval by the OOGA.

2.11 The DGA and OOGA shall liaise from the start of and throughout the project.

2.12 A Geotechnical Advisor shall be a Chartered Member of the ICE, IoM^3 or GSL, or equivalent, and will have at least ten years (or a relevant Masters degree and eight years) relevant post-chartership experience in ground engineering and infrastructure works.

NOTE *This requirement in Clause 2.12 exceeds that of general eligibility for entry onto the Register of Ground Engineering Professionals (RoGEP) at Adviser level.*

2.13 The focal point for the planning, procurement, interpretation and implementation of all geotechnical aspects of the project shall be the DGA acting as the designer's lead professional.

2.14 Where different organisations are sub-contracted to provide specialist input, the management responsibility of geotechnical risks associated with their input shall remain with the DGA.

2.15 The reports required by this document shall identify all of the geotechnical risks associated with the project, and record the mitigations employed to remove/avoid, reduce and control these risks.

2.16 The reports required by this document shall include any residual risks not controlled by mitigation.

2.17 The reports required by this document shall be included in any tender documentation, the pre-construction information and construction phase plan as relevant.

2.18 The reports required by this document shall be included in the OO asset management system.

2.19 The GFR shall form part of the project Health and Safety File required by the SI 2015 No.51 [Ref 9.N].

NOTE *A process flow chart representing the requirements in this document is included in Appendix J.*

2.20 The agreed final version of all reports shall be issued to the OO in a relevant format for transfer into their records management system.

2.21 Geotechnical submissions shall be submitted in the correct order and in a timely manner as agreed between the DGA and OOGA to ensure a sufficient review and revision period between submissions and ahead of project requirements as set out in clause 2.22 below.

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2.22 On receipt of a geotechnical submission with a relevant OO Reference No. and geotechnical certificate signed by the DGA, the OO shall respond either:

1) within a contractually defined time limit; or
2) within any other agreed time limit (generally 28 days)

2.23 A Geotechnical Certificate signed by the DGA shall accompany all geotechnical submissions.

NOTE 1 *A model Geotechnical Certificate is presented in Appendix A.*

NOTE 2 *In design and build contracts the contractor's representative will also need to sign the Geotechnical Certificate.*

2.24 Geotechnical submissions shall be submitted to the OO in accordance with the record management requirements of the OO.

2.25 All drawings shall be aligned for on-screen viewing without the need for rotation.

2.26 All drawings shall include a scale bar, a North point and be georeferenced.

2.27 All geotechnical reports shall have a OO Reference No. included on the front page.

2.28 Where a geotechnical report is referred to in the main text of a report the OO Reference No. shall be cited.

2.29 Factual ground investigation data in AGS format shall be supplied with the submission of the factual report.

2.30 One copy of any factual report and AGS data file produced for the project shall be forwarded to the national Geological Survey appropriate to the location of the project.

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3. Geotechnical risk management and the Geotechnical Risk Register

3.1 Geotechnical risk management requires interaction between all relevant parties and shall continue throughout the asset's life cycle until its removal.

3.2 Geotechnical risk management shall commence as part of project conception with a preliminary Geotechnical Risk Register being presented by the DGA in the Statement of Intent report.

NOTE 1 *The recognition and mitigation of geotechnical risk is a complex process which requires specialist geotechnical knowledge and experience coupled with input from other engineering disciplines.*

NOTE 2 *A sample Geotechnical Risk Register is presented in Appendix B of this document.*

NOTE 3 *DMRB document CS 641 [Ref 4.I] provides advice on what constitutes geohazards posing risks to be considered when developing risk registers for a project.*

3.3 Subsequent geotechnical reports produced by the DGA shall include updated versions of the geotechnical risk register.

3.4 The DGA shall be fully involved in recognising, assessing and mitigating the geotechnical risks.

3.5 The DGA shall ensure that effective communication is established with the construction delivery personnel to ensure that the design requirements are understood by and communicated to the site construction team by the DGA and design team.

NOTE *The requirement above in clause 3.5 is particularly relevant in 'accelerated delivery" working, for examples 'design and build', and 'fast track working'.*

3.6 Controls shall be established by the DGA for adoption by the construction team to ensure that the design is correctly fulfilled.

3.7 Any changes to the geotechnical design required during construction shall be agreed between the DGA and OOGA and recorded.

3.8 The OOGA shall advise whether design changes required during construction are to be recorded in an addendum to the GDR or in the GFR, depending on the scope of the changes.

3.9 The risks documented in the Geotechnical Risk Register shall also be included in the relevant project, regional, health & safety, environmental, Designer's Risk Register and risk assessments (as appropriate to the nature of the document) in order to ensure visibility and mitigation management at the appropriate level.

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4. Geotechnical reporting requirements

4.1 The necessary geotechnical documents produced during the design process shall each be submitted to the OO for review by the OOGA in accordance with the contract and this document.

NOTE *The process described in this DMRB document is aligned to that described in BS EN 1997 [Ref 2.N].*

4.2 The following reports shall be produced in the order listed here:

1) the Statement of Intent (SoI) is compiled by DGA at project conception to explain the extent of the works and identify the preliminary geotechnical risks associated with the delivery of the project. A template for the SoI can be found in Appendix C;
2) the Preliminary Sources Study Report (PSSR) enhances the information in the SoI with detailed desk studies, site reconnaissance and consultation with subject matter experts as required. It expands the list of geotechnical and geoenvironmental risks, identifying and proposing further investigations of those risks likely to have a significant impact on the delivery of the project. A template for the PSSR can be found in Appendix D;
3) Ground Investigation Scope Report (GISR) (see clauses 4.4 - 4.7 below). A template for the GISR can be found in Appendix E;
4) Ground Investigation Report (GIR) (see clauses 4.8 - 4.10 below). A GIR template can be found in Appendix F;
5) Geotechnical Design Report (GDR) (see clauses 4.11 - 4.13 below). A GDR template can be found in Appendix G;
6) Special Geotechnical Measures Form (SGMF) (see clause 4.14 below). A SGMF template can be found in Appendix H;
7) Geotechnical Feedback Report (GFR) (see clauses 4.15 - 4.18 below). It provides a record of the location and nature of materials encountered and how used, particular geotechnical problems and their solutions. A GFR template can be found in Appendix I.

4.3 Following the data assessment in the PSSR stage the scope of exploratory investigation shall be proposed by the DGA in the GISR and be subject to approval by the OOGA.

4.4 The exploratory investigation described in the GISR shall gather geotechnical and geoenvironmental data in those areas where the provision of extra data reduces the geotechnical risks.

4.5 Ground investigation strategy and methodology shall be described in the GISR and follow the procedures described in BS 5930 [Ref 1.N] (including BS EN 1997 [Ref 2.N] and BS 22475 [Ref 3.N] where referenced), BS 10175 [Ref 7.N] and BS 8576 [Ref 5.N].

4.6 Any geotechnical laboratory testing shall be undertaken in accordance with BS 1377 [Ref 8.N] and BS EN ISO 17892 [Ref 4.N].

4.6.1 The GISR may be incorporated as an Appendix in the PSSR if agreed by OOGA.

4.7 A GISR shall also be produced for any subsequent ground investigation work.

4.8 The Ground Investigation Report (GIR) shall summarise and interpret all of the information from previous work and include or reference the Factual Report.

4.9 The GIR shall contain a final section which describes the geotechnical options considered and the final choices made.

NOTE *The GIR will form part of the supporting evidence for the technical approval process required by CG 300 [Ref 8.I].*

4.10 No company specific disclaimers shall be attached to the GIR.

4.11 The Geotechnical Design Report (GDR) shall include full details of the interpretation of design data, justification for and presentation of the design.

4.12 The GDR shall include relevant geotechnical specification clauses, layout drawings for the works and requirements for supervision, monitoring and future maintenance.

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4.12.1 No works covered by the GDR should be commenced until the relevant certification for that part of the works has been completed.

4.13 The Special Geotechnical Measures Form (SGMF) shall only be used by agreement between the DGA and OOGA and/or when required for SGM design to be subcontracted for particular works (for example, reinforced soil).

4.14 The Geotechnical Feedback Report (GFR) shall be produced by the DGA within six months of the end of the construction phase.

4.15 The GFR shall highlight any area of the specification or standards to be reviewed in the light of problems encountered on site.

4.16 The GFR shall identify any requirements for ongoing monitoring or specific maintenance.

4.17 After geotechnical certification the GFR shall be incorporated into the project Health and Safety File and also stored in the OO records and management systems.

4.18 The format of each report shall be decided in discussion between the DGA and the OOGA and recorded in the SoI.

4.18.1 The Appendices provide content lists for each report. These may be used as templates for the report or as check lists if a more flexible approach is adopted (for example using maps, plans, text, tables, annotated drawings, etc.) to ensure that these points are covered.

4.18.2 Depending on the scale, complexity and geotechnical category of the works it may be appropriate to combine some of the reports required above and/or amend their content.

4.18.3 Merging of reports may be done with the agreement of the OO and recorded in the SoI or subsequent report as relevant.

4.19 All geotechnical reports shall be available through all of the project stages to all relevant parties.

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5. Geotechnical category

5.1 Geotechnical categories as defined in BS EN 1997 [Ref 2.N] shall be assigned to all geotechnical work within a project.

5.2 The categories shall be agreed by the OOGA and DGA as soon as the project brief has been agreed, irrespective of procurement method and/or design/construction responsibilities.

5.3 The agreed geotechnical categories shall be recorded in the SoI.

NOTE *The geotechnical categories do not correspond to structures categories described in DMRB document CG 300 [Ref 8.I].*

5.4 The geotechnical category shall be reassessed whenever the design changes or at other appropriate milestones.

5.5 Any change of geotechnical category shall be recorded in the relevant report.

5.6 Where it is decided that no further geotechnical certification is required beyond a certain stage this decision shall be made in discussion with the OOGA.

5.7 A geotechnical category 3 area of work shall be subject to checking by an independent checking consultant (ICC) except where the OOGA has waived this requirement.

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6. Geotechnical certification

6.1 The geotechnical certificate submitted with each of the documents described in Section 4 shall take the form presented in Appendix A.

6.2 When used, a SGMF shall include its own certificate.

NOTE *A template for an SGMF can be found in Appendix H.*

6.3 The geotechnical certificates shall be signed by the DGA and, where appropriate, also by the contractor (for example within design and build contracts).

6.3.1 The geotechnical certificates should be countersigned by the OOGA as either:

1) received (submission accompanying the certificate is accepted);
2) received with comments (as follows) (submission accompanying the certificate is generally acceptable but requires amendment); or
3) returned marked comments (as follows) (submission accompanying the certificate is unacceptable and shall be revised and resubmitted.)

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7. Specific risks and requirements with trenchless construction

7.1 Trenchless technology covers a range of techniques for constructing crossings up to 2m diameter beneath motorways and trunk roads without excavation across the carriageway. The trenchless methods used shall create a stable bore to contain a service.

7.2 The risk of damage to existing services shall be minimised.

7.3 The risk of encountering previous trenchless crossings shall be minimised.

NOTE *Previous trenchless crossings can include aborted trenchless work in the vicinity.*

7.4 Ground movements caused by the proposed crossing shall be mitigated or minimised.

NOTE 1 *Heave can affect the ground or services overlying the proposed crossing due to either physical displacement of the ground by the methods employed or by pressures in drilling fluids exceeding the overburden pressure at the proposed crossing level.*

NOTE 2 *Settlement can affect the ground or services overlying the proposed crossing due to:*

1) the necessary overbreak required by the installation method;

2) the collapse of material onto the permanent works installed into the crossing;

3) incorrect management of fluid pressures in the support medium for the crossing (possibly combined with incorrect control of the installation rate causing lack of face support allowing migration of material into the works during the installation);

4) the loss of material into the completed crossing via unsealed gaps either between elements of the crossing or at connections.

7.5 Monitoring of the ground surface over the line of the proposed works shall be undertaken before, during and after the works and over a time scale agreed by the OOGA.

NOTE *Monitoring of the ground surface will allow any pre-existing issues to be recognised, allow control of the works, demonstrate whether movements are consistent with predictions and (reported via the GFR) enable improved predictions to be made in future works.*

7.6 The horizontal and vertical profiles of the works following completion shall be recorded in the GFR.

NOTE *In particular, with deep crossings or where abortive attempts have been made, there is a risk of future intrusive works encountering the crossing and causing service damage or risk to the operators of the intrusive plant (for example if the crossing contains a high pressure and/or high voltage service, etc.).*

7.7 In addition to the reporting described in Section 4 and the relevant appendices, information for trenchless works shall be included in the reporting.

7.7.1 In the SoI, PSSR, GIR, and GDR the following trenchless construction information should be recorded, as relevant to the works:

1) the methodology proposed in relation to ground conditions;
2) any restrictions on the proposed excavation method;
3) spoil handling and disposal;
4) ground water control (including pumping or well pointing) and ground stability issues;
5) pipe loadings;
6) predicted and critical settlement or heave;
7) full details and purpose of monitoring requirements including operational restrictions and reading frequency;
8) clearance assumptions to other assets (for example vertical and horizontal distances from structures, existing underground and overground services);
9) proposals for demonstrating the effective identification and location of existing utilities;
10) method statements demonstrating effective choice of methods, personnel and supervision;

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11) emergency procedures for dealing with situations that would require traffic management or reduce the safety of road users;
12) the location and types of materials anticipated;
13) groundwater conditions;
14) the short-term and long-term stability of the launch and reception pits and support methodology;
15) scope of records to be taken and kept during construction.

7.7.2 The following should be recorded in the GFR relevant to trenchless construction:

1) dates of work with start and finish times including stoppage details;
2) bore diameter, installed pipe material and diameter, length installed, OS grid reference, levels, vertical and horizontal profiles, and joint packing (if tunnelling methods used);
3) support fluids, fluid pressures, viscosity, fluid balance (inflow compared to outflow in order to monitor and control losses) or spoil discharge, thrust rate, torque;
4) ground and groundwater conditions.

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8. Specific risks and requirements in areas of underground void risk and past mining

8.1 All risks arising from works in areas of mineworkings or underground voids shall be avoided, reduced or mitigated.

8.2 Where mitigation measures against the risk from mineworkings and other underground voids are proposed, these shall be agreed with the OO.

8.3 At the outset, the likelihood of mining/underground void risks shall be established and reported in the SoI.

8.3.1 CIRIA documentation regarding abandoned mineworkings CIRIA C758D [Ref 1.I] and CIRIA SP32 [Ref 2.I] may be consulted and considered.

8.4 Research shall include available sources of geological information (including 1:10560 and 1:10000 mapping and memoirs where available), local mining and natural voids knowledge to improve knowledge regarding the likelihood of voids being present, or, whether an unworked mineral, of past or present potential commercial value, is present.

NOTE *Old mine workings are not invariably obvious from surface features, and can include coal, evaporites (for example salt, as brine or halite), chalk, oil shale, fireclay, building materials and metal ores. Workings can be present in any areas where these minerals exist although records of them could not be available.*

8.5 In mining areas, the DGA shall seek advice from the Coal Authority at an early stage.

8.6 Where the Coal Authority makes specific requirements on precautionary structural measures under enabling statutes, these shall be implemented with the approval of the OO.

NOTE *Coal Authority advice includes information to minimise risks arising during ground investigations in coal mining areas and assist designers in taking structural precautions to minimise possible effects of subsidence from coal mining activity.*

8.7 Where directed by the OOGA, a Coal Authority High Level Report shall be submitted by the DGA.

8.8 Investigation works shall be agreed with the OOGA and may include the use of non-intrusive works leading to and informing intrusive works.

8.9 Permissions for intrusive works into coal bearing strata shall be obtained from the Coal Authority.

8.10 Old mine entries that are recorded or suspected close to or below a highways asset and there is no, or poor, records of any treatment shall be investigated and appropriate treatment undertaken to ensure that they do not present significant risk to the project or its end users.

NOTE *There have been recent examples where treatments undertaken at the time of existing motorway construction have failed.*

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9. Normative references

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Ref 1.N	BSI. BS 5930, 'Code of practice for ground investigations'
Ref 2.N	BSI. BS EN 1997, 'Geotechnical Design. Part 1: General rules, Part 2: Ground investigation and testing and National Annexes'
Ref 3.N	BSI. BS 22475, 'Geotechnical investigation and testing'
Ref 4.N	BSI. BS EN ISO 17892, 'Geotechnical investigation and testing'
Ref 5.N	BSI. BS 8576, 'Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs)'
Ref 6.N	Highways England. GG 101, 'Introduction to the Design Manual for Roads and Bridges'
Ref 7.N	BSI . BS 10175, 'Investigation of potentially contaminated sites. Code of practice'
Ref 8.N	BSI. BS 1377, 'Methods of test for soils for civil engineering purposes'
Ref 9.N	The National Archives. legislation.gov.uk. SI 2015 No.51, 'The Construction (Design and Management) Regulations 2015'

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10. Informative references

The following documents are informative references for this document and provide supporting information.

Ref 1.I	CIRIA. CIRIA C758D, 'Abandoned mineworkings manual '
Ref 2.I	CIRIA. CIRIA SP32, 'Construction over abandoned mine workings '
Ref 3.I	Welsh Assembly Government. MGRG (W), 'Managing Geotechnical Risk. Implementation Guidance - Wales'
Ref 4.I	Highways England. CS 641, 'Managing the maintenance of highway geotechnical assets'
Ref 5.I	Highways England. MCHW Series 1600, 'Manual of Contract Documents for Highway Works, Volume 1 Specification for Highway Works. Series 1600 Piling and Embedded Retaining Walls'
Ref 6.I	Highways England. MCHW Series 500, 'Manual of Contract Documents for Highway Works, Volume 1 Specification for Highway Works. Series 500 Drainage and service ducts.'
Ref 7.I	Highways England. MCHW Series 600, 'Manual of Contract Documents for Highway Works, Volume 1 Specification for Highway Works. Series 600 Earthworks'
Ref 8.I	Highways England. CG 300, 'Technical approval of highway structures'

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Appendix A. Geotechnical certificate

Certificate to be used by the Designer for certifying the design of geotechnical works. Variations to be agreed by discussion between the DGA and the OOGA.

Geotechnical Certificate

OO Reference No.:

1. We, the 'Design Organisation' (insert name) certifies that the submitted information for the geotechnical activities listed below have been prepared by us with reasonable professional skill and diligence, and that in our opinion:

i. constitutes and adequate and economic design for the project

ii. appropriate solutions to all the reasonably foreseeable geotechnical risks have been incorporated

iii. the work intended is accurately represented and conforms to OO's requirements

iv. with the exception of any item listed below or appended overleaf, the documentation has been prepared in accordance with the relevant documents from the Design Manual for Roads and Bridges and the Manual of Contract Documents for Highway Works.

and, where necessary,

v. The design elements covered in this certificate are not detrimental to the design elements previously certified and not amended by this certificate. [end Note 1]

LIST OF SUBMITTED INFORMATION

DEPARTURES FROM DMRB DOCUMENTS (List or None)

INCORPORATION OF GEOTECHNICAL DATA INTO CONSTRUCTION DETAILS (where relevant)

The reports, design data, drawings or documents listed above have been accurately translated onto the construction drawings or other design documents bearing the unique numbers listed below/appended overleaf.

.....

Signed and dated by the DGA

Where necessary, also signed with date and organisation by the Contractor (agent or Contracts Director)

Countersignature by Overseeing Organisation (*delete or strike through as necessary)

This Certificate is:

(a) received*

(b) received with comments as follows.*

(c) returned marked 'comments' as follows:*

.....

Signed and dated by the OOGA

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Note

'Received' = Submission accompanying certificate is accepted

'Received with comments' = Submission accompanying certificate is generally acceptable but requires amendment.

'Returned marked comments' = submission accompanying certificate is unacceptable and should be revised and resubmitted.

* Delete as necessary

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Appendix B. Geotechnical Risk Register

The Geotechnical Risk Register is an essential tool in tabular format for managing geotechnical risks to the OO asset. In the context of reporting, it demonstrates to the OOGA (and OO) that the geotechnical risks are being effectively recognised and mitigated by the DGA. The Geotechnical Risk Register commences in the SoI and is subsequently updated throughout the project cycle through to the GFR where any residual risks are recorded for operation/maintenance.

The risk register, together with the basis for scoring the occurrence and severity, presents the geotechnical risks alongside their likelihood of occurrence and severity of impact with the product of these being the risk rating. Only geotechnical risks are to be included in the geotechnical risk register.

An example of a geotechnical risk register is included in Figure B.1.

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Figure B.1 Example of a geotechnical risk register

Risk classification and required action

Likelihood		Severity				
		1	2	3	4	5
		Minor	Moderate	Serious	Major	Catastrophic
1	Extremely unlikely	1	2	3	4	5
2	Unlikely	2	4	6	8	10
3	Likely	3	6	9	12	15
4	Extremely likely	4	8	12	16	20
5	Almost certain	5	10	15	20	25

Risk Classification	
Low (1-8)	Ensure assumed control measures are maintained and reviewed as necessary.
Medium (9-19)	Additional control measures needed to reduce risk rating to a level that is equivalent to a test of "reasonably required" for
High (20-25)	Activity not permitted. Hazard to be avoided or risk to be reduced to tolerable level.

The risk classification is the product of the likelihood and the severity

Potential severity of harm occurring		
1	Minor	Minor damage or loss - (no human injury)
2	Moderate	Moderate damage or loss - (Slight injury or illness)
3	Serious	Substantial damage or loss - (Serious injury or illness)
4	Major	Major damage or loss - (Fatal injury)
5	Catastrophic	Catastrophic loss or damage - (Multiple fatalities)

Risk ID	Hazard	Consequence	Likelihood	Severity	Risk	Mitigation	Likelihood	Severity	Residual risk
1	Solution features within areas underlain by limestone (including chalk).	Ground collapse.	5	4	20	Undertake appropriate ground investigations, including geophsyics and dynamic probing where relevant, in areas of known risk. Use to inform suitable design/construction	1	4	4
2	Compressible ground, such as peat and/or alluvium.	Instability during/after construction and relatively high settlement in earthworks/structures.	4	3	12	Develop appropriate ground model from PSSR and GIR to inform suitable design and construction controls.	1	3	3
3	Poorly backfilled/reinstated longitudinal service trenches and leaking pipework (e.g. drains, communications and electricity supply ducts) particularly at slope shoulders or mid-slope.	Water ingress into slope causing instability/failure.	4	4	16	Ensure appropriate specification documentation provided to site personnel to emphasise the need to mitigate this risk. Works to be supervised by an appropriately qualified and experienced geotechnical professional.	1	4	4
4	Settlement/heave during trenchless construction beneath the existing carriageway.	Damage to existing carriageway, services and related assets. Safety issues and disruption to road users.	4	3	12	Establish a survey network to allow live monitoring of the carriageway during and after works together with appropriate monitoring/control of drilling operations. Undertake works beneath carriageway within a single shift. Ensure appropriate emergency procedure in place, including traffic management and alternative route(s).	2	3	6

Note: the above entries are purely for example only and do not relate to any specific scheme..

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Example - Develop project specific register

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Appendix C. Recommended content for Statement of Intent

C1 Project

Name and details of the project including OO Reference No., brief description of location [including National Grid Reference(s)], location plan and any areas outside the current OO asset to be included in the project.

C2 Objectives

C3 Existing information

Summary of supporting information that has been identified to date.

C4 Geotechnical risk

1) Preliminary summary of key geotechnical risks that are envisaged including a preliminary assessment of the likelihood of underground voids or mining (see also Section 8 and Appendix B).

2) An initial assessment of the geotechnical category

C5 Proposed studies and investigations

Outline of proposed studies and investigations that are to be undertaken to achieve geotechnical certification.

C6 Specialist consultation

Details of any specialist consultations required with reasons

C7 Programme

Estimated programme of work involved in preparation of the PSSR, GISR and GIR and any physical work required up to their completion.

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Appendix D. Recommended content for preliminary sources study report

D1 Title sheet(s)

Including the name of the project, the report title, details of the authorship, report and version number, OO Reference No. and date of issue.

D2 Introduction

1) Reference to SoI and any subsequent changes to the project;
2) Limits of study area and record of relevant previous geotechnical studies;
3) Confirm or change the geotechnical category.

D3 Sources of information, desk study, site reconnaissance, site description and review of findings

1) Details of all enquiries made and of all sources used for geotechnical, historical and other relevant information with nil or negative responses also reported. The findings may be incorporated into separate blocks in this section (for example statement of geological information consulted followed directly by a review of findings);
2) The review carried out by the designer of all existing relevant geotechnical information (for example geomorphological/geological mapping, GI work, drainage/hydrological studies, etc. Any included relevant photographs should be clearly referenced;
3) Sources reviewed to include:
   a) topographical maps;
   b) historical maps;
   c) geological maps (1:50,000 and 1:10,000 scale) and memoirs;
   d) aerial photographs (old and recent);
   e) records of mines and mineral deposits (including Mineral Valuer's report), drainage;
   f) remote sensing data from third parties (for example satellite data);
   g) as-built drawings;
   h) existing monitoring data;
   i) services drawings;
   j) land use and soil survey information;
   k) archaeological and historical investigations;
   l) existing ground investigations (including relevant investigations carried out for the OO and the results of those investigations);
   m) relevant Information held on asset data systems operated by the OO or third parties. The OO asset data management system should be interrogated to assist the assessment of geotechnical risks;
   n) consultation with statutory bodies and agencies, for example flood records.

D4 Site reconnaissance

1) Description of findings of site reconnaissance (site walkover) undertaken for this report;
2) Any recent geotechnical data obtained since the SoI.

D5 Ground conditions

1) Comprehensive study of information described in D3 & D4;
2) Description of soils and/or rocks identified in D3 & D4 items above with engineering properties and significance of geotechnical conditions;
3) Contaminated land and ground-gas assessment (geoenvironmental assessment) as appropriate to a highway project.

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D6 Preliminary engineering assessment

1) For each soil and/or rock type and/or location preliminary consideration of the design, construction and operation implications including:
   a) General - location, classification, earthworks acceptability criteria, groundwater, likely difficulties and risks, areas/features to avoid;
   b) Cuttings – side slopes (short- and long-term stability), potential acceptability of material, special drainage or ground treatment, swelling/heave risks;
   c) Embankments – side slopes, characteristics and restrictions on use of particular geomaterials, plant use options, drainage requirements, foundation treatment, settlement;
   d) Subgrade – likely strength assessment for cutting areas and for potential fill materials in embankments, capping layers and availability of material, drainage requirements;
   e) Structure foundations – alternative types of foundation likely to be applicable, high level estimates of bearing pressures and settlements, groundwater, risk areas/strata, potential construction difficulties etc;
   f) Geochemistry – possibility of harmful elements (including gases) present in soil, rock or groundwater and implications of these on human health and safety and deterioration of the works. Scope for the reuse of marginal/recycled material within the works;
   g) Any existing geotechnical risks such as slope failures, slopes with marginal factors of safety, very soft/highly compressible soils and solution features, mine workings or other known void risks (see Section 8);
   h) Effects of man-made obstructions, archaeology, mining, site history etc.

D7 Comparison of project options and risks

1) Summarise all relevant geotechnical factors, which are likely to influence the OO asset and the project;
2) An updated geotechnical risk register building on that included in the SoI;
3) Risks of undertaking proposed geotechnical engineering activities assessed and their management described;
4) The geotechnical risks associated with the various routes/options for multi-option schemes;
5) A description of the geotechnical options considered and a statement of the preferred route/options (on geotechnical grounds) if appropriate.

D8 Drawings and photographs

1) Site plan (including scale bar to allow clarity when on-screen viewing) with study limits and project options. Plans to show geotechnical and geoenvironmental constraints and hazards. Geological longitudinal sections with cross-sections where appropriate. Where appropriate, drawings should present existing and proposed ground levels;
2) Photographs, both ground and aerial, used in the study should be reproduced and referenced to the site plan.

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Appendix E. Recommended content for Ground Investigation Scope Report (GISR)

1) If a standalone report, on the title page include the name of the project, the report title, details of the authorship, report and version number, OO Reference No., and date of issue;
2) If a standalone report, include the geotechnical risk register.

E1 Objectives

1) The scope of the ground investigation for a project, as discussed and agreed between the DGA and the OOGA, also including land outside the current OO asset that falls within the scope of the works;
2) Specific risks to be investigated identified and described.

E2 Proposed investigation

1) Fieldwork - tabular details of exploratory work proposed with reasons for choice of investigatory method with respect to mitigating previously assessed risks;
2) Laboratory work - tabular details of proposals with reasons for choice of test, relevance to previously assessed geotechnical risks and benefits.

E3 Site and working restrictions

Known physical constraints to investigation works.

E4 Specialist consultation

Details of and reasons for, if proposed.

E5 Programme

Anticipated start dates, contract periods, restrictions on programme, cost estimates (VAT excluded) for factual and interpretive work. Arrangements for contract work and supervision of contract.

E6 Reporting

Responsibility for reporting. Factual data supplied in electronic report format suitable for upload to the OO record system and in AGS format.

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Appendix F. Recommended content for Ground Investigation Report (GIR)

F1 Title sheet

1) Name of the project, the report title, OO Reference No., reference, details of the authorship, the version number and date of the report.
2) Reference to SoI and PSSR. Description of project changes since the SoI and PSSR were produced.

F2 Introduction

1) Scope and objectives of the report;
2) Brief description of the project;
3) Geotechnical category;
4) Other relevant information.

F3 Existing information

A review presented by the designer of all existing relevant geotechnical information available on the project. The PSSR will be a basis for this section but the information should be updated as necessary when such information is of a time-limited nature.

F4 Field and laboratory studies

This section is to describe the investigations carried out by the designer as part of the design process:

1) geomorphological/geological mapping and topographic survey;
2) ground investigations (description of the investigations carried out by the designer, including an outline of the aims and reasoning behind the requirement for the investigation);
3) description of fieldwork;
4) results of in situ tests;
5) drainage studies;
6) geophysical surveys;
7) test pile results;
8) other field work;
9) laboratory investigation;
10) description of tests;
11) factual data to be supplied in electronic report format suitable for upload to the OO's record system and in AGS format.

F5 Ground summary

A summary interpretation of the results of the investigations undertaken and the derived material parameters for design. Ground model(s) to be used for design to be presented either for the whole site or for recognisably different areas of work. Where appropriate, drawings including any long sections updated with new geotechnical or topographic data, etc. An update to the geoenvironmental model should be presented including the findings of ground investigations.

F6 Geotechnical Risk Register

An update of the Geotechnical Risk Register.

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F7 Engineering assessment

The designer's engineering assessment of all of the geotechnical and geoenvironmental information gathered, including for land outside the OO current asset which falls within a scheme. The assessment includes a description and justification of the geotechnical options that have been considered for use in the scheme. It presents justified engineering reasoning for the chosen geotechnical option for all, or individual elements, of the scheme for reference during technical approval in DMRB document CG 300 [Ref 8.I] (where relevant) and taken forward into the GDR.

F8 References

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Appendix G. Recommended content for Geotechnical Design Report

1) Include full details of the interpretation of design data and justification for the design and include relevant layout drawings;
2) The report is to be subdivided into sections on cuttings, embankments, structures and, where SGM are utilised, to be further subdivided for each unique earthwork or structure and submitted in sections to suit the design and construction programme;
3) Include drainage design (both surface and sub-surface) relevant to earthworks, structures subgrade design and capping;
4) Schedules and drawings (plans, elevations, sections with typical details, construction sequence, risks (and their mitigations) cross referenced to specification appendices;
5) A discussion of contamination and remediation requirements (if required);
6) Description/diagram of idealised soil structure model(s) to be used in analysis;
7) Full description of proposed use of the observational method, if proposed and agreed by the OOGA, including details of monitoring and control;
8) Any monitoring, control and maintenance required during the service life to be described.

G1 Cuttings

Full details of the methods of slope analysis/output, soil/rock parameters, drainage, slope angles, formation parameters for pavement design and other considerations. Summary of design including location, side slopes, maximum and typical depths, relevant site investigation, assumed soil/rock strata and ground water conditions, earthworks, drainage requirements and pavement design. Information may be tabulated or submitted as a series of summary forms.

G2 Embankments

Full details of the methods of analysis/output, soil parameters, drainage, slope angles, formation parameters for pavement design and other considerations. Summary of design including location, side slopes, maximum and typical depths, relevant site investigation, assumed soil strata and ground water conditions, predicted settlements, earthworks, drainage requirements and pavement design. Information may be tabulated or submitted as a series of summary forms.

G3 Highway structures

Full details of the structure type, method of analysis and soil parameters assumed in design of foundations, retaining elements and the SGM. Summary of design including allowable bearing pressures, pile capacity, earth pressures, differential settlement and protection against chemical attack to be provided for each structure. Information may be either tabulated or submitted as a series of summary forms.

G4 SGM

In addition to the above for slopes, embankments or structures as relevant, the working width (space required for a system or method of working, for example vehicle restraint systems, access space, and suchlike) of OO's assets cannot be compromised by the construction of geotechnical structures. In particular the serviceability performance of potentially flexible SGM such as reinforced soil, soil nail solutions, and similar requires careful consideration and reporting.

G5 Drainage

Details of how the drainage design will address the groundwater conditions and how groundwater risks are to be managed.

G6 Pavement design, subgrade design (including the need for in-situ treatment, etc.) and capping

Method of analysis, soil parameters, ground water assumptions.

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G7 Contamination and ground gas risks

1) Summary of the extent of the contamination testing that has been undertaken;
2) Description of the liaison that has been undertaken with the statutory authorities and the scope of risk assessments carried out to comply with regulatory authorities requirements. This section is to include a summary of the current status with regards to regulatory approval, recording the acceptance of these risk assessments by the regulatory authority;
3) Summary of the findings and conclusions of the risk assessments including the site remediation requirements that have been agreed with the OO and regulatory authorities;
4) Any restrictions placed on the chemical content of materials to be used in the works, that is what it is acceptable to leave on the site and what needs to be removed from site. This can be presented in terms of limits for U1A and U1B in accordance with MCHW Series 600 [Ref 7.I];
5) Details of contaminated materials (described using the SHW classifications) to be removed from site;
6) Materials management plan.

G8 Ground treatment (including void stabilisation)

G9 Geotechnical Risk Register

An update of the Geotechnical Risk Register.

G10 Specification appendices

Details of parameters and amendments for the specification appendices completed in Annex 1(see G13).

G11 Instrumentation and monitoring

Full details of purpose, installation requirements, restrictions, frequency of readings, trigger levels, review methodology and mitigation methods should trigger levels be exceeded.

Use of observational methods/controls. Predicted and critical readings, restrictions on work and alternative approach to be taken if critical readings exceeded.

G12 Pile testing requirements

G13 Annex 1

Completed specification table 1/5 and MCHW series MCHW Series 500 [Ref 6.I], MCHW Series 600 [Ref 7.I], MCHW Series 1600 [Ref 5.I] appendices including tables 6/1, 6/2 and 6/3.

G14 Annex 2

Completed SGMFs where appropriate (see Appendix H).

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Appendix H. Recommended content for Special Geotechnical Measures Form

The decision to utilise this form to be agreed between the DGA and the OOGA.

H1 Format

1) Project details;
2) Name of project;
3) Type of highway;
4) Permitted traffic speed;
5) Nature of project/project element (for example new highway construction, highway widening, earthworks maintenance).

H2 SGM

1) Generic type of SGM, for example strengthened soil, gabions, soil nailing, crib wall, chemical additions, electro-osmotic treatment;
2) Purpose of SGM, for example to allow highway widening, for earthworks failure reinstatement, for new construction in area of restricted land take;
3) Intended location(s) for use (a schedule of proposed lengths of SGM and locations).

H3 Outline of existing ground and groundwater conditions (to be referenced to the relevant sections of the GIR)

1) Ground investigation data (list report references and comment on extent of data);
2) Existing ground conditions (brief summary of natural geological sequence, presence of 'made ground', etc);
3) Existing groundwater conditions (note on groundwater levels);
4) Geochemistry (note on sulphate/chloride/pH conditions and/or ground contamination and microbiological action);
5) Existing geotechnical risks (any factors of geotechnical significance related to the existing ground conditions, for example slope failures, solution features; mineworkings, slopes with marginal factors of safety, very soft/highly compressible soils).

H4 Proposed SGM

1) Description of SGM (range of and average height of proposed strengthened earthwork in its final form, i.e. slope face angle, facing/landscaping details including, where appropriate, topsoil and planting details);
2) Foundation preparation where appropriate, including any measures to deal with geotechnical risks;
3) Materials to be used in construction (description of geosynthetics, soil nails, gabion baskets, imported fill materials etc., including Design Certificates and evidence of CE marking under the Construction Products Directive where appropriate);
4) Drainage measures (particular drainage control measures to be incorporated);
5) Arrangements for highway furniture, buried services and landscaping (relevant details);
6) Inspection and maintenance (particular inspection and maintenance requirements [including where appropriate the maintenance of vegetated slope faces] and non-routine inspection and maintenance requirements);
7) Interface with structures (details of interface construction measures with bridges, abutments, retaining walls, buried structures, other SGM, etc.).

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H5 Design methods

1) List of relevant documents;
2) Limit state design criteria. (Factors to be applied in the design, on both stability of the SGM and on stability of associated slopes);
3) Serviceability design criteria (any total/differential settlement or other movement criteria adopted by the designer, including any imposed by employer's requirements);
4) Relevant parameters for soils and materials (schedule of relevant main parameters for the soils and other materials to be used in construction);
5) Design groundwater conditions (statement of worst case, or range of conditions to be used in design);
6) Live loadings (confirmation of live loadings to be assumed in design);
7) Description/diagram of idealised soil/structure model to be used in analysis (provide a section of the SGM strengthened earthwork to illustrate the design method and associated main design assumptions);
8) Precautions against chemical attack to materials (measures to accommodate ground or material conditions);
9) Proposed Departures from DMRB design documents.

H6 Checking

Designer to indicate the independent checking procedures where employed.

H7 Signature format for SGMF:

The above design and construction proposals are submitted for review.

Geotechnical team leader, design team and, where relevant, also by the Contractor's agent or contracts director

On behalf of:

Geotechnical Certificate ref. no.:

Countersignature by Overseeing Organisation

This SGMF is:

(a) received*

(b) received with comments as follows:*

(c) returned marked 'comments' as follows:*

(*delete as necessary)

Signed and dated by OOGA

Note:

'Received' = Submission accompanying certificate accepted

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'Returned marked comments = Submission accompanying certificate is unacceptable and should be revised and resubmitted.

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Appendix I. Recommended content for Geotechnical Feedback Report (GFR)

As described in clause 4.18 of this document, the style is to be agreed between the DGA and the OOGA. For example, annotated drawings and tables may be simpler to produce and assimilate than descriptive text, and the report may be submitted in parts to suit the construction progress. Where possible, as-built details to be transferred directly to the OO asset management system.

I1 Title sheet

Clearly indicating the name of the project together with the title (for example Geotechnical Feedback Report), OO reference no., and version and date of the report.

I2 Introduction

1) Scope and object of the report;
2) Limits of the area covered by the report;
3) Bibliography of project specific geotechnical reports;
4) Other relevant information.

I3 Earthworks

1) General description of the earthworks;
2) Issues encountered that were not envisaged in the GDR and their solutions;
3) Weather conditions;
4) Application of acceptability criteria;
5) Haul conditions and types of plant used;
6) Comparison of predicted and actual quantities of acceptable and unacceptable material (described using the SHW classifications);
7) Topsoil and planting;
8) Details of any validation reports prepared to demonstrate compliance with a site remediation strategy and the requirements of the regulatory bodies.

I4 Cuttings

1) For each cutting, location of materials excavated and their subsequent destination in the works (with dates);
2) Plant used and details of issues encountered;
3) Instability issues and unusual ground conditions;
4) Issues associated with ground water and drainage measures to overcome them and their locations;
5) Contaminated and hazardous material encountered on site and the location of disposal, both on and off site.

I5 Embankments

1) For each embankment, source and location of all material (described using the SHW classifications placed - with dates);
2) Plant used and details of issues encountered;
3) Instability issues and unusual ground conditions;
4) Foundation treatment, including drainage measures, treatment of soft areas and their locations;
5) Settlement of foundation and fill material.

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I6 Subgrade/capping/pavement

1) Method of subgrade preparation, details of capping materials (described using the SHW classifications) used and details of any issues encountered;
2) Method of placing each pavement layer and details of any issues.

I7 Drainage

1) Details of temporary drainage and its effectiveness;
2) Methods of installing permanent drainage, details of any issues encountered and any specific requirements for long-term maintenance.

I8 Imported materials

1) Types of imported materials and their use;
2) Source of imported materials (described using the SHW classifications) and their location in the Works (with dates);
3) Acceptability and performance.

I9 SGM

1) Description of SGM types and locations;
2) Full record of SGM used;
3) Fill materials used;
4) Record of soils and groundwater conditions encountered and drainage measures required;
5) Inspection and maintenance requirements;
6) Details of any in-situ testing;
7) Details of any issues encountered.

I10 Structure foundations

1) Record of soil/rock and groundwater conditions encountered;
2) Temporary works required and their effectiveness;
3) Details of any issues encountered;
4) Pile logs summary, pile test results and other relevant information;
5) Settlement records with dates of each major stage including backfill of abutments and approach fills;
6) Details of as-built foundations.

I11 Materials testing

1) Summary of site laboratory testing;
2) Separate section on each type of test giving a summary of all results together with comments on them and their effectiveness. (If a material report is prepared by the testing organisation then this should be used as the basis for this section with the actual report attached as an appendix to the GFR).

I12 Instrumentation

1) Location and details of instruments;
2) Purpose, performance and usefulness;
3) Readings (with dates) and predicted values;
4) Details and effects of resulting action;

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5) Comment on need to continue monitoring. Full details of purpose, installation requirements, restrictions, frequency of readings, trigger levels, review methodology and mitigation methods should trigger levels be exceeded.

I13 Summary of issues experienced and design changes

1) Summary of issues and details of design changes to overcome them;
2) Comments on how issues might be avoided in the future, including suggested revisions required to the SHW and DMRB.

I14 Geotechnical Risk Register

An update of the geotechnical risk register to include any residual risks associated with the works to be carried forward into operation and non-routine maintenance that they may require.

I15 Residual health and safety risks

1) Details of any residual health and safety risks associated with ground hazards on the project that would need to be considered if future work is carried out by the maintaining authority, for examples residual contamination, potential ground gas. Make reference to the Health and Safety File where appropriate;
2) Photographs should be included in the report to illustrate particular points.

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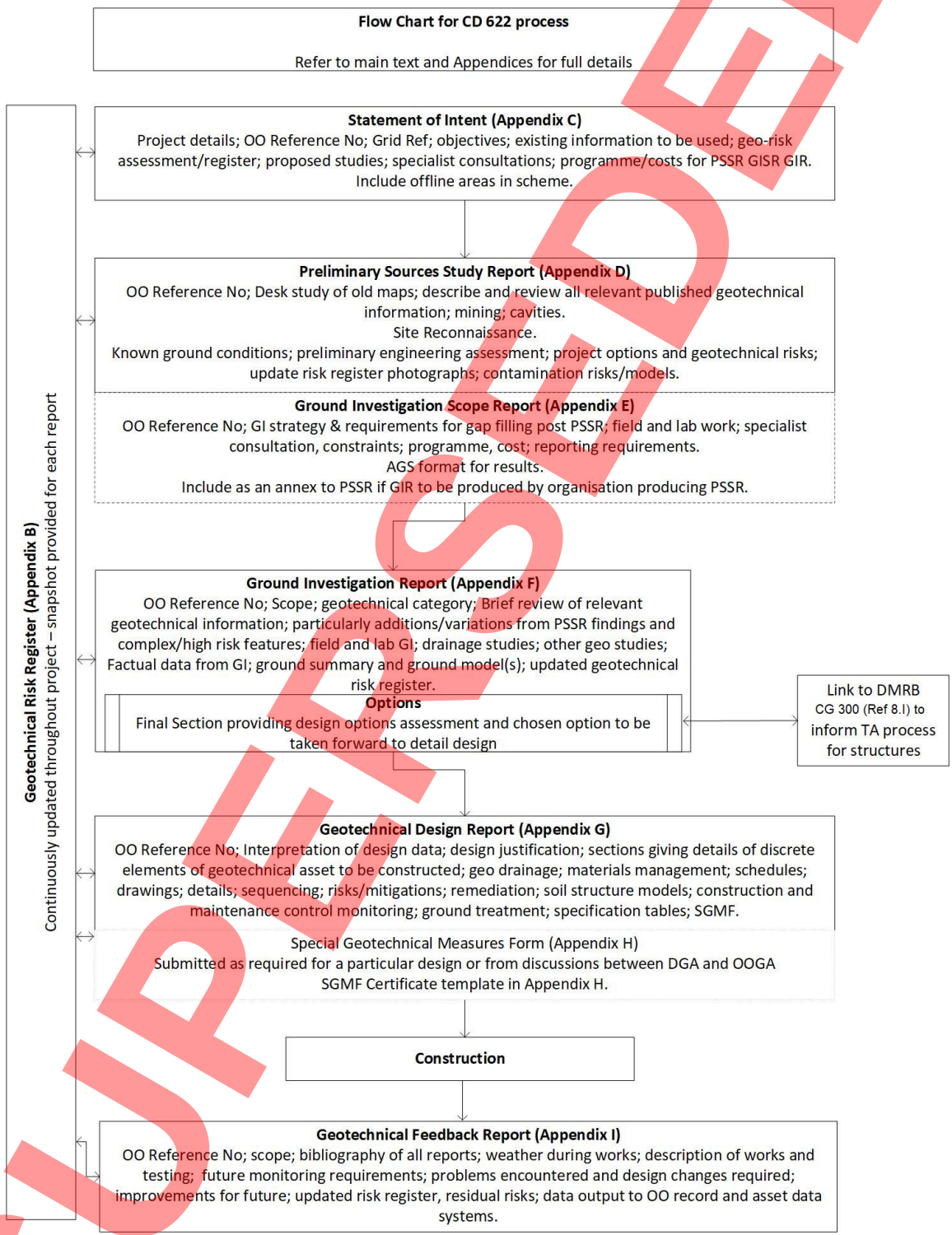
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Appendix J. Flow chart of CD 622 process

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Figure J.1 Process flowchart for managing geotechnical risk



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Geotechnics
Design

CD 622
England National Application Annex to CD 622 Managing geotechnical risk

(formerly HD 22/08, BD 10/97, HA 120/08)

Revision 0

Summary
There are no specific requirements for Highways England supplementary or alternative to those given in CD 622.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated Highways England team. The email address for all enquiries and feedback is: Standards_Enquiries@highwaysengland.co.uk

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Release notes **2**

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Release notes

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0	Aug 2019	Highways England National Application Annex to CD 622.

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Department for Infrastructure
An Roinn Bonneagair

Geotechnics
Design

CD 622
Northern Ireland National Application Annex to CD 622 Managing geotechnical risk

(formerly HD 22/08, BD 10/97, HA 120/08)

Revision 0

Summary
There are no specific requirements for Department for Infrastructure, Northern Ireland supplementary or alternative to those given in CD 622.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated team in the Department for Infrastructure, Northern Ireland. The email address for all enquiries and feedback is: dcu@infrastructure-ni.gov.uk

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0	Aug 2019	Department for Infrastructure Northern Ireland National Application Annex to CD 622.

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Geotechnics
Design

CD 622
Scotland National Application Annex to CD 622 Managing geotechnical risk

(formerly HD 22/08, BD 10/97, HA 120/08)

Revision 1

Summary
This National Application Annex gives the Transport Scotland specific certification and checking requirements for managing geotechnical risk.

Feedback and Enquiries
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Release notes

Version	Date	Details of amendments
1	Mar 2020	Revision 1 (March 2020) Update to remove reference to SH 4/89. Revision 0 (August 2019) Transport Scotland National Application Annex to CD 622.

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Foreword

Publishing information

This document is published by Highways England on behalf of Transport Scotland.

This document supersedes HD 22/08, BD 10/97, HA 120/08, which are withdrawn.

This document supplements DMRB document CD 622.

Contractual and legal considerations

This document forms part of the works specification. It does not purport to include all the necessary provisions of a contract. Users are responsible for applying all appropriate documents applicable to their contract.

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Introduction

Background

In Scotland, for road projects promoted by the Trunk Road Authority, the principles of CD 622 are adopted, but differing organisational structures mean that separate certification and checking requirements are in place. This necessitates the production of a National Application Annex to cover the difference.

Assumptions made in the preparation of this document

The assumptions made in GG 101 [Ref 1.N] apply to this document.

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S/1. Scope

S/1.1 In Scotland, for road projects promoted by the Trunk Road Authority, the principles of DMRB document CD 622 shall be adopted except for certification and checking requirements (see clause below).

S/1.2 Transport Scotland shall be contacted for details of separate certification and checking requirements.

NOTE *Differing organisational structures mean that separate certification and checking requirements are in place.*

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S/2. Normative references

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Ref 1.N	Highways England. GG 101, 'Introduction to the Design Manual for Roads and Bridges'

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Llywodraeth Cymru
Welsh Government

Geotechnics
Design

CD 622
Wales National Application Annex to CD 622
Managing geotechnical risk

(formerly HD 22/08, BD 10/97, HA 120/08)

Revision 0

Summary
There are no specific requirements for Welsh Government supplementary or alternative to those given in CD 622.

Feedback and Enquiries
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