HD 22/08: Managing Geotechnical Risk
Implementation Guidance – Wales

DMRB 4.1.2

December 2009
1 Introduction

1.1 Why Geotechnical Certification?

Ground-related problems can adversely affect project cost, completion times, profitability, health and safety, quality and fitness for purpose, and can also lead to environmental damage.

Geotechnical risk is the risk to building and construction work created by the hazards associated with site ground conditions.

Geotechnical risks are only one part of total project risks. However, multidisciplinary teamwork involving all stakeholders including early input from a Geotechnical Specialist will ensure that project risks are identified and then overcome or managed efficiently.

Geotechnical certification is used to ensure that ground related hazards are identified and the associated risks effectively managed to mitigate the potential adverse effects that they can cause. Proactive management of geotechnical risk will add value to your project whilst compliance with HD22/08 will also provide an audit trail that will avoid unintentional departures from standards. Total project costs are likely to be reduced.

1.2 Some definitions

The key geotechnical roles involved in the certification process are the Designer’s Geotechnical Advisor (DGA) and the Overseeing Organisation’s Geotechnical Advisor (OOGA). Those appointed to the above roles shall both have the experience of a Geotechnical Adviser as follows:

A Geotechnical Adviser is:

- A Chartered Engineer or Chartered Geologist with a minimum of five years practice as a Geotechnical Specialist.

A Geotechnical Specialist is:

- A Chartered Engineer or Chartered Geologist with a minimum of five years practice in geotechnics post chartership; or
- A Chartered Engineer or Chartered Geologist with three years practice in geotechnics post chartership plus a postgraduate qualification in geotechnical engineering or engineering geology equivalent to an MSc.

The Overseeing Organisation for the trunk road network in Wales is the Welsh Assembly Government.

1.3 When does HD22/08 apply?

All projects where Geotechnical Activities are involved shall be certified. Geotechnical Activities shall include without limitation, the design, construction and maintenance of:

a) Earthworks.
b) Strengthened Earthworks.
c) Ground Investigations, both intrusive and non-intrusive.
d) Excavation/assessment below sub-base level.
e) Earth retaining structures.
f) Structural foundations and excavations.
g) Excavations for tunnels and service ducts.

This is a broad definition and consequently many schemes are likely to require certification in line with HD22/08. If the geotechnical risks are low, however, then the burden of certification can be reduced by agreement between the DGA and OOGA on a case by case basis.

1.4 Scope and application
HD22/08 applies to:

a) Projects promoted by the Assembly Government, Roads and Projects Division (R & P D), where it is responsible for procurement of both design and construction. This would generally comprise the Trunk Road Forward Programme.

b) Projects promoted by the Welsh Assembly Government, R & P D, where the design and construction procurement is the responsibility of a Third Party. This would generally comprise projects undertaken by the three Trunk Road Agencies and Traffic Wales.

c) Those parts of projects promoted by a Third Party where they adjoin or otherwise affect the Welsh Trunk Road network. This would generally comprise projects undertaken by utility companies.

d) Planning applications/projects referred to the Welsh Assembly Government for direction where they adjoin or otherwise affect the Welsh Trunk Road network.

e) Projects where geotechnical information is required as part of assessment, design and or remedial works for structures covered by BD2 (Technical Approval of Highway Structures (DMRB 1.1)).

f) Installation by trenchless or other techniques of service crossings. BD2 requires geotechnical certification in support of Approvals in Principle (AiP). AiPs are required for service tunnels with an excavated bore diameter greater than 900mm. HD22/08 requires geotechnical certification for any tunnel installed using trenchless techniques where the internal diameter is less than 2000mm. In short all trenchless works including tunnelling require geotechnical certification.

g) The design of remedial works to rectify defects affecting the Geotechnical Asset which is defined as ‘a principal asset of the highway network, comprising the foundations to pavement and structures, together with land within the highway boundary through which the route is formed (including cuttings, embankments, pavement subgrade and a diverse range of natural geological strata and man-made materials)’.

h) Temporary works involving geotechnical activities that affect the Assembly Government’s asset.

Notes.

i. To facilitate the Trunk Road Agencies ability to proactively manage geotechnical risks on the Welsh Trunk Road network the Assembly Government is considering development of a Welsh Assembly Geotechnical Data Management System (WAGDMS).

ii. In agreement with the Welsh Highways and Utilities Committee (HAUC) the National Street Gazetteer (NSG)) should include details of ‘geotechnical difficulty’ on the Trunk Road network to flag up particular geotechnical hazards and associated risks which will require management by implementation of the requirements of HD22/08. This could be under the section on ‘Special Engineering Difficulty’ or in the ‘Restriction on Works section’. Note that 3rd party installations beneath motorways and trunk roads require a Section 61 agreement under the New Roads and Street Works Act (NRSWA). This ensures that all the cost of certification is borne by the third party.

iii. Assembly Government Development Control officers should obtain sufficient advice to assess the Geotechnical Category of the scheme applied for (see section 3). Where it is considered that projects/planning applications represent a significant risk to the Assembly Government’s asset they should be classified as Geotechnical Category 2 or 3 and a planning condition should be recommended along the lines of ‘The developer shall comply with the requirements of the Design Manual for Roads and Bridges (DMRB), HD22 – “Managing Geotechnical Risk” and shall submit required reports for review and certification by the Welsh Assembly Government’s appointed Geotechnical Advisor’. Where it is considered that projects/planning applications represent only a minor risk they should be classified as Geotechnical Category 1 and a planning condition recommended along the lines of ‘No works shall be undertaken which could in any way affect the adjacent trunk road’. To discharge this condition, details of the applicant’s proposals in the temporary and permanent case should be reviewed by the OOGA who will review the Geotechnical Classification and provide comment as appropriate on the works proposed. Note that the OOGA may conclude that the presented details are sufficient to discharge the planning condition or may re-classify the scheme to Geotechnical Category 2 or 3..

iv. HD22/08 does not generally apply to structures covered by BD94/07 (Design of Minor Structures (DMRB 2.2.1) though where foundations are on slopes the stability of the ground needs to be taken into account and specialist geotechnical advice should be sought.

v. The procedures to be followed for risk management of geotechnical assets (see HD41 (DMRB 4.1.3) Maintenance of highway geotechnical assets) are those detailed in HD22/08. Whilst the works proposed comprise only inspections HD22/08 should be taken as guidance only. However, the reporting and certification requirements of HD22/08 should be initiated as soon as ground
investigations (including installation of any monitoring regime) or remedial/preventative works are proposed.

vi. The DGA will need to ensure that geotechnical risks associated with temporary works are included in the Geotechnical Risk Register and are considered and managed in principle (noting that the design of them will remain with the Contractor) to mitigate adverse effects to the project including, but not limited to, total construction cost and construction health and safety risks. The DGA and OOGA should be provided with an opportunity to review and comment upon the Contractors temporary works design prior to construction.

2 Management of Geotechnical Risks

2.1 Geotechnical risks and hazards

To be effective in terms of managing geotechnical risks so as to mitigate potential adverse impacts on projects (and potentially identifying opportunities for adding value to a scheme) geotechnical risk management should be commenced as soon as possible following project identification. The establishment, development and refinement of the Geotechnical Risk Register is an essential tool to aid management of geotechnical risk whilst also providing effective communication of such risks to other members of the design team to ensure that geotechnical risks are not managed in isolation. Appendix D of Standard HD41 (DMRB 4.1.3) Maintenance of highway geotechnical assets) provides advice on what constitutes geo-hazards that pose risks and will therefore need to be considered when developing the Geotechnical Risk Register for a project. The advice given in that standard is reproduced below.

The principal geotechnical hazards which affect Highway Geotechnical Assets, and which may also affect the other principal assets of the network may be summarised as including:

i. Instability in natural and man made slopes of soil, rock, and fill.
ii. Weak and compressible strata
iii. Adverse groundwater conditions due to changes in the groundwater regime, or to defective drainage, and which may influence material behaviour.
iv. Scour and erosion from adjacent watercourses, and from temporary flooding.
v. Instability associated with active or ancient dissolution features, for example, in calcareous rock formations (particularly chalk [limestone in Wales]) but also those containing salt and gypsum.
vi. The instability of former mine workings or mine entries affecting the land surface.

vii. Subsidence due to current or future mining.
viii. Instability and subsidence due to landfill.
ix. Ground and groundwater chemistry and the potential adverse effects on construction materials (e.g. sulphate attack on buried concrete, including the thaumasite form of sulphate attack).
x. The effect of potential leachate from adjacent landfill, and minewater issues following the cessation of pumping.
xi. Highway drainage acting as a conduit for the migration of leachate from landfill sites.
xii. Expiration of the design life of soil nails, geogrids or other engineering materials or works.
xiii. The destabilising effect of animal burrows.
xiv. The destabilising effects that can result from vegetation, or the removal of vegetation.
xv. Instability resulting from changes in loading, or any other changes from the original design assumptions.

The potential impact of the proposed works (in the permanent or temporary case) on third party assets should also be considered and the geotechnical risks managed so as to minimise the risk of third party claims. Such risks should be included in the Geotechnical Risk Register and will be subject to this geotechnical certification process. Secondary activities offset from the principal construction works and the highway asset but that entail geotechnical risk (eg development and restoration of borrow pits) will not be the subject of geotechnical certification though the DGA should ensure that the geotechnical risks are appropriately managed.

2.2 Key stages in geotechnical certification
The table below summarises the Key Stages to be followed to ensure the procurement of the geotechnical information necessary to undertake an accurate assessment of project risks together with the five reports that underpin the certification process.

<table>
<thead>
<tr>
<th>Key Stage</th>
<th>Title</th>
<th>Geotechnical reporting requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Stage 1</td>
<td>Initial Review of Project</td>
<td>Statement of Intent (SOI)</td>
</tr>
<tr>
<td>Key Stage 2</td>
<td>Preliminary Certification</td>
<td>Preliminary Sources Study Report (PSSR) Ground Investigation Report (GIR)</td>
</tr>
<tr>
<td>Key Stage 3</td>
<td>Geotechnical Design and Construction Certification</td>
<td>Geotechnical Design Report (GDR)</td>
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<tr>
<td>Key Stage 4</td>
<td>Geotechnical Feedback</td>
<td>Geotechnical Feedback Report (GFR)</td>
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Further guidance on the requirements of each stage is provided in sections 3 and 4 below.

### 3 Geotechnical Certification Procedures

#### 3.1 Geotechnical classification and geotechnical reporting and certification requirements

In order to establish the Geotechnical Certification requirements of a project it shall be reviewed at project inception to determine its Geotechnical Category which is based on a consideration of project complexity, proposed geotechnical activities, presence of geo-hazards and severity of geotechnical risks. The Geotechnical Category of a scheme shall be reviewed as additional geotechnical data is procured and revised as necessary which may result in a change to reporting requirements. The table below provides a summary of the Geotechnical Categories including notes on associated reporting requirements and certification.

<table>
<thead>
<tr>
<th>Geotechnical Category</th>
<th>Project details</th>
<th>Reporting requirements and certification ¹.</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>No geotechnical activities involved (see section 1.3)</td>
<td>HD22/08 does not apply and the project file should be annotated accordingly.</td>
</tr>
</tbody>
</table>
| Geotechnical Category 1 | Small and relatively simple structures, earthworks and geotechnical activities.  
                           | Geotechnical activities/structures with negligible risk of overall stability, ground movements and known ground conditions.  
                           | No or straightforward excavation below water table. | A separate PSSR is not required and may be combined with the GIR. A reduced scope GFR is appropriate and can be agreed with the OOGA. |
| Geotechnical Category 2 | Conventional types of geotechnical structures, earthworks and activities  
                           | No exceptional geotechnical risks, unusual or difficult ground or loading conditions.  
                           | The majority of geotechnical activities with highways should fall into this category. | Full compliance with HD22/08. Separate PSSR and GIR are required. |
| Geotechnical Category 3 | Projects which involve geotechnical activities or structures which fall outside the limits of Categories 1 and 2.  
                           | These projects include very large, unusual or complex geotechnical activities, earthworks and structures or those involving abnormal geotechnical risks or unusual or exceptionally difficult ground conditions. | Full compliance with HD22/08. Separate PSSR and GIR are required. |

Note: ¹. All completed reports and associated geotechnical certificates should be filed on the project file and scheme Health & Safety file as a minimum.

A copy of a draft Geotechnical Certificate to be used for schemes in Wales is included at the end of this guidance (see also section 9).

### 4 Key Stage 1 – Initial Review of Project
Key stage 1 procedures can be summarised as:

- Design Organisation to determine initial Geotechnical Classification and appoint a DGA for all Geotechnical Category 1, 2 or 3 projects.
- DGA to complete preliminary Geotechnical Risk Register and incorporate into the Statement of Intent (SOI). Where the SOI is completed prior to agreement of a preferred route alignment the SOI should consider all options. The format of the SOI is mandatory and is given in Appendix B of HD22/08.
- For Geotechnical Category 1 schemes the SOI should include Annex A (issued with the PSSR for Geotechnical Category 2 & 3 schemes) and include sufficient information to justify the scope of any proposed ground investigations.
- DGA to submit SOI for review and certification by the OOGA appointed by the Welsh Assembly Government.
- Following agreement of the SOI the OOGA will issue a signed Geotechnical Certificate and the DGA can proceed to Key Stage 2.
- Following submission of the SOI the OOGA and DGA can develop and agree project specific protocols to deal with subsequent reporting and certification requirements which shall be recorded in the project file. Any agreed project specific protocols should be reviewed at each subsequent Key Stage and following any revision of the Geotechnical Category.

5 Key Stage 2 – Preliminary Certification

Key Stage 2 procedures can be summarised as:

- Geotechnical Category 1 projects
  - DGA to complete a combined PSSR and GIR incorporating an updated Geotechnical Risk Register and submit to the OOGA for review and certification. Where the combined report is completed prior to agreement of a preferred route all route options under consideration should be addressed. Geotechnical Category to be reviewed following assessment of newly acquired geotechnical data and/or revision of the scheme design. The preferred formats of the PSSR and GIR are given in Appendix C and D respectively of HD22/08.
  - Following agreement of the combined report the OOGA will issue a signed Geotechnical Certificate and then the DGA can proceed to Key Stage 3.

- Geotechnical Category 2 and 3 projects
  - DGA to complete the PSSR incorporating an updated Geotechnical Risk Register and issue to the OOGA for review and certification. Where the PSSR is completed prior to agreement of a preferred route the PSSR should include all route options under consideration. Geotechnical Category to be reviewed following assessment of newly acquired geotechnical data and/or revision of the scheme design. The preferred format of the PSSR is given in Appendix C of HD22/08. Annex A to the PSSR should be completed detailing proposed ground investigations.
  - Following agreement of the PSSR the OOGA will issue a signed Geotechnical Certificate and then the DGA can proceed to procurement and completion of the agreed ground investigation. Procurement and specification should conform to the requirements of the Manual of Contract Documents for Highway Works Vol 5 Section 3.
  - DGA to complete the GIR incorporating an updated Geotechnical Risk Register and issue to the OOGA for review and certification. Geotechnical Category to be reviewed following assessment of newly acquired geotechnical data and/or revision of the scheme design. The format of the GIR is given in Appendix D of HD22/08.
  - Following agreement of the GIR the OOGA will issue a signed Geotechnical Certificate and then the DGA can proceed to Key Stage 3.

6 Key Stage 3 – Geotechnical Design and Construction Certification

Key Stage 3 procedures can be summarised as:

- Geotechnical Category 1, 2 and 3 projects
• DGA to complete the GDR incorporating an updated Geotechnical Risk Register (including assessment of geotechnical risks associated with potential temporary works options) and issue to the OOGA for review and certification. Geotechnical Category to be reviewed following assessment of newly acquired geotechnical data and/or revision of the scheme design. The format of the GDR is given in Appendix E of HD22/08.

• Following agreement of the GDR the OOGA will issue a signed Geotechnical Certificate and then the scheme can progress to construction. Sectional certification of the GDR to permit construction to commence on approved elements is acceptable.

• The GDR shall be provided to the Overseeing Organisations Site Nominee (OOSN) for guidance.

• Should there be a need for additional ground investigations to be carried out during the course of a main works contract; or if the design is amended from that contained in the certified GDR, then this additional/amended work shall be subject to Geotechnical Certification as detailed above commencing with a re-issue and certification of Annex A of the PSSR.

• The DGA and OOGA should be provided with an opportunity to review and comment upon the Contractors temporary works design prior to construction.

7 Key Stage 4 – Geotechnical Feedback

Key Stage 4 procedures can be summarised as:

• Geotechnical Category 1, 2 and 3 projects

  • The Geotechnical Feedback Report (GFR) shall be completed by the Designer’s Site Staff in association with the DGA (who will need to approve and certify the report) and shall be submitted to the OOGA for review within 6 months of project completion. The format of the GFR is given in Appendix F of HD22/08. It will be the DGA’s responsibility to ensure that the Designer’s Site Staff are fully briefed as to the data required to complete the GFR.

  • A reduced scope GFR is appropriate for Geotechnical Category 1 schemes and can be agreed with the OOGA.

  • The GFR should be produced as an independent document, but once accepted by the OOGA should be incorporated within the Health and Safety File produced for the scheme.

  • As built drawings should be suitable for electronic storage with all drawings and plans scalable from the digital version.

  • During the course of the construction process, any significant differences between the actual conditions found and those expected are to be reported formally in writing by the Designer to the OOSN, who in turn shall report them to the Overseeing Organisation without delay. The consequences of these differences shall be reported in the GFR.

8 CDM Regulations

The reports produced as part of the Geotechnical Certification process can be used to fulfil the requirements of the CDM regulations as they shall document the residual project Health and Safety risks and the methods employed to avoid, reduce and control these. The reports shall be included in any tender documentation and the pre-construction information and construction phase plan. They shall subsequently form part of the Health and Safety File.

Where reports are completed prior to agreement of a preferred route they should include all route options under consideration including an updated Geotechnical Risk Register; in which the risks of the primary hazards are assessed, the consequences of these risks to the project determined, and details of how the risks are to be managed given. CDM implications should be highlighted.

9 Costs and responsibilities

All costs for compliance with HD22/08 should be sourced from project funds with third parties being responsible for funding this element of their own projects. Note that 3rd party installations beneath motorways and trunk roads require a Section 61 agreement under the New Roads and Street Works Act (NRSWA). This ensures that all the cost of certification is borne by the third party.
10 Compliance checking

All submissions by the DGA for certification should first be reviewed by the appropriate project manager prior to passing to the OOGA. An additional Compliance Checking section has been added to the Geotechnical Certificate as detailed in the draft certificate contained at the end of this guidance. On review of each submission the PM should sign this certificate to confirm acceptance of responsibility for the submission being completed in accordance with HD22/08.

11 Dispute resolution

Effective management of geotechnical risks and the associated reporting and certification requirements of HD22/08 require the development of good and pragmatic working relationships between the OOGA and the DGA. Should there be a conflict with the two named parties this should be dealt with by escalation within the two employing organisations. Ultimately the decision of the OOGA who is acting for the Overseeing Organisation is final though at no stage should the OOGA take on any design responsibility which must remain with the DGA. Issues should only be escalated to the Overseeing Organisation to confirm its tolerance to risk to ensure that the risks are mitigated to an acceptable level and that design solutions do not incorporate excessive cost.
GEOTECHNICAL CERTIFICATE

Geotechnical Certificate

Scheme Title

Geotechnical Certificate

(* Delete as Appropriate)

Certificate Seq. No .....
4. INCORPORATION OF GEOTECHNICAL DATA INTO CONSTRUCTION DETAILS

*where the certificate is accompanying final design data the following statement shall also be included*

* The Reports, Design Data Drawings or Documents listed in 2 above have been accurately translated onto the construction drawings or other designs documents bearing the unique numbers listed below/appended overleaf.*

Signed: ........................................

Designer (Designer Geotechnical Advisor)
Name: ........................................
Date: ........................................
On behalf of ......................................

*Signed: ........................................

*Contractor(1) (Agent or Contracts Director)
Name: ........................................
Date: ........................................
On behalf of ......................................

(1) For Contractor read also all Third Parties responsible for the works (e.g. utility company, statutory undertaker or developer with appropriate planning consent).

5. COMPLIANCE CHECK.

I am satisfied that the submitted documents detailed in section 2:

i. have been completed in line with the requirements of HD22/08

ii. incorporate approved design proposals/options; and

iii. are acceptable for submission to the Overseeing Organisations Geotechnical Advisor for review and certification.

Signed: ........................................

* Welsh Assembly Government, Roads and Projects Division
* Trunk Road Agency
* Traffic Wales
Name: ........................................
Role: ........................................
Date: ........................................

This Certificate is:

(a) received*(see note)
(b) received with comments as follows:* (see note)
(c) returned marked “comments” as follows:* (see note)

Signed: ........................................
Overseeing Organisation Geotechnical Advisor
Name: ........................................
On behalf of ......................................
Date: ........................................

Note:
RECEIVED = SUBMISSION ACCOMPANYING CERTIFICATE IS ACCEPTED.
RECEIVED WITH COMMENTS = SUBMISSION ACCOMPANYING CERTIFICATE GENERALLY ACCEPTABLE BUT REQUIRE MINOR AMENDMENT WHICH CAN BE ADDRESSED IN SUBSEQUENT REVISIONS.
RECEIVED MARKED COMMENTS = SUBMISSION ACCOMPANYING CERTIFICATE UNACCEPTABLE AND SHOULD BE REVISED AND RESUBMITTED.