

HAGDMS Slope Hazard Rating data description

Introduction

The Slope Hazard Rating (SHR) layer on HAGDMS provides the output of an analysis into the performance of the major Geotechnical Assets of Highways England (HE). An initial iteration of the SHR analysis was carried out in 2014, and the associated layer (along with the note on its derivation, available on the HAGDMS downloads page) will remain on HAGDMS. This is to ensure that reference can still be made to this initial iteration if it has been cited in any reports or other documents produced for HE. This latest revision of the SHR layer **should be used from this point forward**, as it reflects a revision to the methodology to calculate the SHR, outlined in this document and the latest available data cut at the time of development, detailed in Table 1 below. It is important to note that there is **no equivalence** between the results obtained in the 2014 analysis to those in this 2017 update for a given Geotechnical Asset. Due to the changes in the methodology outlined below, it is entirely possible that an asset will change its Slope Hazard Ratings between the analyses carried out. This **does not** infer an improvement or degradation of asset performance. Likewise, there is no equivalence of the colour coding used between the 2014 and 2017 analyses as shown on HAGDMS, the two datasets stand alone and should be considered separately.

Table 1 Summary details of the dataset used in the Slope Hazard Rating

Dataset	Provider	Data Currency
HAGDMS Geotechnical Asset Database (GAD)	HAGDMS	28-09-2016

The SHR layer is intended to be used as an initial high level hazard awareness map. It **does not** replace the need for consideration of hazards through the existing HD22/08 and HD41/15 processes of HE, the need to discuss issues with HE geotechnical advisors or the need to consider the specific performance of individual geotechnical assets (through the use of detailed information held in GAD).

The map is one of a suite being developed to assess hazards to the Strategic Road Network. It can be accessed on the HAGDMS (HE Geotechnical Data Management System) where it can be viewed in the map legend at the following location: Geotechnics > Hazards > Slope Hazard Rating (2017). The map is visible at a scale less than 1:200,000.

Methodology

The methodology for the calculation of the SHR has been modified for this (2017) iteration. Whilst fundamentally similar to the initial methodology (from 2014, which is described in detail in the note on its derivation), the modifications seek to improve the analysis by:

- Consideration of only Major Earthworks (Cuttings, Embankments and Bunds). Minor Earthworks are excluded from the analysis,
- Improved filtering of the observations used to determine the performance of the asset cohorts, to only include those which can be related to relevant slope stability issues (through use of GAD tick boxes and key word searching in the observation descriptions),
- Update to the observation weightings to take account of changes in the HD41/15 revision,
- Review, and update where required, of the geological code grouping, to take account of improved knowledge, some of which has been gained through liaison with other major UK transportation infrastructure owners.

The updated analysis methodology is shown in Figure 1 below. The geotechnical assets included in the analysis (those which have Preliminary and Approved status) are assigned to a cohort based on geological grouping (refer to Table 1, Appendix A), and the morphology factor of their highest point (refer to Table 2, Appendix A.).

Within each cohort, the total length of defect, at risk and repair observations is then calculated, having first filtered these to include only observations which are related to slope instability. The total lengths are determined for:

- Major defects (Class 1A),
- Minor defects (Class 1D),
- At risk areas (Class 2),
- Repairs (Class 3).

The total lengths are then weighted for importance (in relation to asset performance), using the values set out in Table 3, Appendix A, and summed for each cohort. The weighted lengths of observations are expressed as a percentage of the total length of earthworks within the cohort. For clarity this percentage is referred to as the Weighted Length.

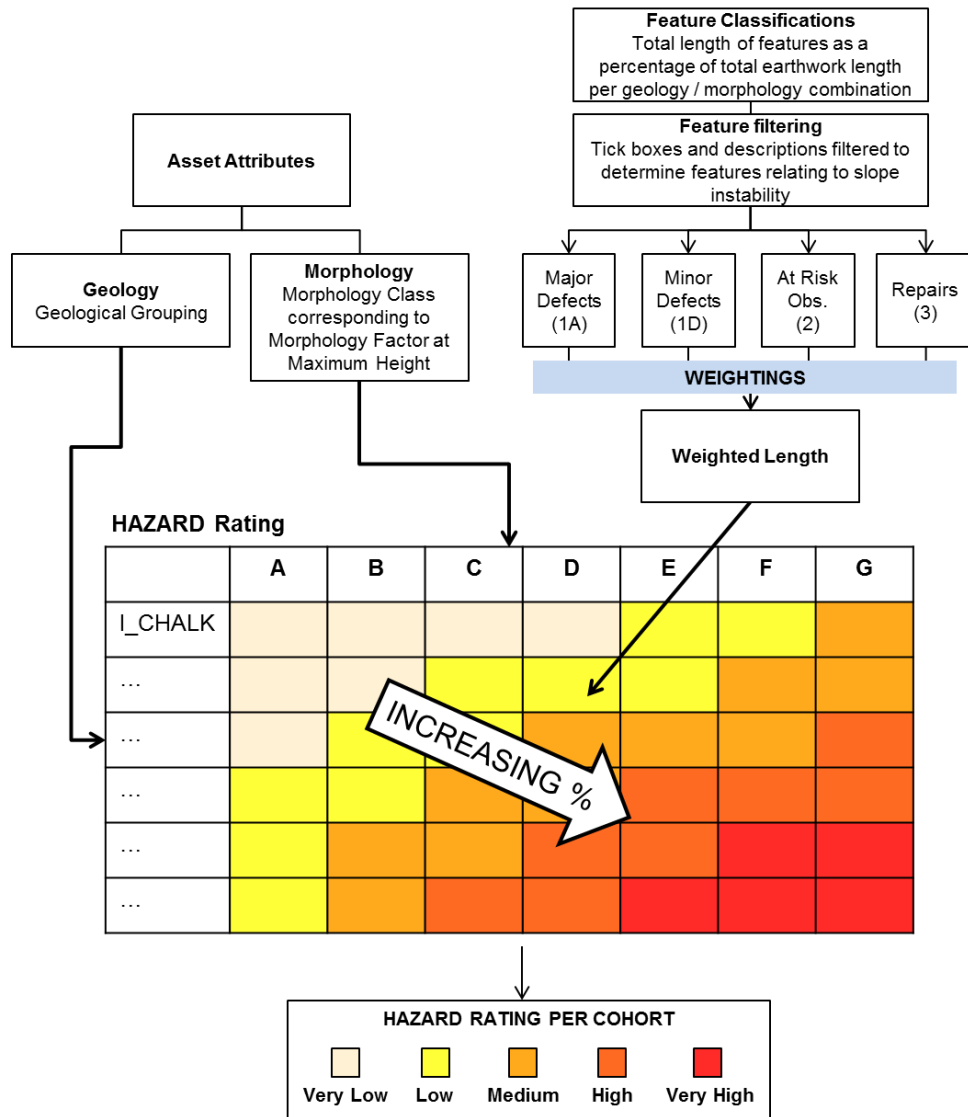


Figure 1 Slope Hazard Rating analysis methodology

In order to rank earthworks in a meaningful way based on their assigned Weighted Length value, a banding of cohorts into five Slope Hazard Ratings was undertaken. The boundaries between Ratings (in the form of a Weighted Length value) have been selected based on achieving a doubling of asset counts between rating bands, with the lowest ratings being assigned to larger numbers of assets than the higher ratings. This banding approach is identical to that used in the 2014 iteration of the SHR calculation. The Weighted Length boundaries used are shown in Table 4 in Appendix A. The Weighted Lengths and assigned Hazard Ratings for each cohort are presented in Table 5 in Appendix A.







Data Source

The 2017 iteration of the Slope Hazard Rating is based on a data cut of the HAGDMS Geotechnical Asset Database taken on 28-09-2016 (as detailed in Table 1). Any applicable geotechnical assets added to HAGDMS after this date will not be included in the analysis, and likewise any assets deleted after this date will be included. The SHR represents an analysis of the performance of the geotechnical assets at that date, and any changes to observations, or addition of new observations, after that date, will not be represented in the SHR output.

The Result

The result of the analysis is a thematic map layer, based on extents of geotechnical assets, with the SHR banded into six ratings (Very Low to Very High and No rating). A summary of the Slope Hazard Rating categories can be seen in Table 2.

Table 2 Summary of Slope Hazard Rating banding

Slope Hazard Rating	Colour	Explanation
Very Low		Lowest SHR applied in this cohort (approximately 52% of rated assets)
Low		Next lowest SHR applied in this cohort (approximately 26% of rated assets)
Medium		Middle rated SHR applied in this cohort (approximately 13% of rated assets)
High		Second highest rated SHR applied in this cohort (approximately 6% of rated assets)
Very High		Highest rated SHR applied in this cohort (approximately 3% of rated assets)
No Rating		No SHR applied, as asset cannot be represented within one of the cohorts

Highways England Contacts

To obtain further advice on the Slope Hazard Rating, or for any other issues associated with ground-related hazards potentially affecting the Strategic Road Network, please contact one of the Geotechnical Advisors available within Table 3 below.

Table 3 Contact details of HE Area Geotechnical Advisors

Highways England Geotechnical Advisor	Area of responsibility	E-mail
Mark Shaw	Areas 1,2,6,8	mark.shaw@highwaysengland.co.uk
Jan Marsden	Areas 3,4	jan.marsden@highwaysengland.co.uk
Raphael Lung	DBFO Area 5	raphael.lung@highwaysengland.co.uk
Dennis Sakufiwa	Areas 7,9	dennis.sakufiwa@highwaysengland.co.uk
Richard Shires	Areas 10,13	richard.shires@highwaysengland.co.uk
Lesley Benton	Area 12	lesley.benton@highwaysengland.co.uk
Shaun Clarke	Area 14	shaun.clarke@highwaysengland.co.uk

Future Developments

Comments or feedback on the Slope Hazard Rating map would be welcomed, and should be addressed to the Project Sponsor within Highways England:

David Patterson

david.patterson@highwaysengland.co.uk

Appendix A

Table 1 Geological Groupings

Geological Grouping	BGS Geology Codes
In situ Groupings	
I_ALLUVIUM AND PEAT	ALF, ALGD, ALRT, ALV, MAAL, MDU, MEA, OMEA, PEAT, PTAL, RBDU
I_CHALK	BDMA2, CK, CKR, CSMA3, HCK, KU, LCK, LECH, LPBLL, LPMB, LSNCK, MCK, MR, MUCK, NCK, NPCH, PCK, RCK, SECK, SPCH, UCK, WMCH, ZZCH
I_CLAY	ACCO, ACVT, ADB, BCLC, BOC, BRB, BRK, BRYD, CLGB, CLSL, COLV, CORF, CWF, DIAM, DVY, DYSM, FOUN, GLLD, GLSC, GST, GSTC, HEAD, HEAD1, HEB, HRR, LAC, LASI, LDE, MARF, MM1, MM3, MM4, PCS, PELC, RIDS, SBC, SLIP, TFD, TILL, TTB, WHI, WIDS, WL, WOC, WPIT
I_LIMESTONE	ABBR, BFLS, BNLS, BO, BRL, BTH, BWL, CARB, CB, CBL, CL, CLR, CR, CU, GL, GNP, GOF, GOG, GOL, GSCL, GSTL, INO, IOGO, LELH, LLKL, LLL, LLST, LMJ, LTLS, MGL, PRMT, TSL, ULL, UNL, WOL
I_MADE GROUND	MGR, WMGR
I_MUDSTONE	ABM, ACM, ACU, ANSH, AS, ATF, AW, AYB, BAN, BCMU, BKF, BNF, BUSS, BVM, CBP, CBRD, CDF, CKF, CLEB, DHLS, DYS, ELM, ETM, FEFR, GRAD, JURA, KRS, KST, LCM, MCM, MFDC, MMG, MOI, PMLS, PNG, RG, SAH, SAL, SKE, SNT, TCF, TPT, TVY, TWM, UCM, ULC, WHG, WIT, YF
I_OTHER ROCK	10FT, 27YD, 2FCC, 2FTC, 2FTV, 4FTC, 5FTC, AB, ABH, ACKW, ACR, ACTO, ALY, BLK, BND, CARA, CMBH, CMV, CWRU, DBLB, DST, EDT, EDW, EN, EYCL, FCF, FLUV, FMCB, GRNT, GUN, HPBR, HVBR, KHS, LDVY, LMC, LO, LTK, LUDL, LUW, MCF, MDT, MDVS, MFSG, MRSL, NMRN, POAN, RMSM, ROX, SFG, SMGP, STAM, TBR, TGM, TLM, TPSF, TR, TRIA, TVF, UC, UDVS, UMAZ, UO, VOLC, WAWK, WBCT, WBY, WEN, WESH
I_OVERCONSOLIDATED CLAY	AC, AMC, AMKC, ASD, BAC, BLCR, BLI, BM, BMN, BNT, BOF, BWC, CHAM, FE, FMB, GAB, GLT, GRBL, GRF, GUGS, KC, KLB, KLOX, LC, LI, LIGO, LIO, LLIC, LMBE, MHC, NEC, ODTL, OXC, PET, RB, RLD, SAB, SASH, SLSY, SMD, STWE, THT, WC, WDC, WHM, WRB, WTT
I_SAND AND GRAVEL	ALC, BAS, BASG, BDS, BGGR, BGP, BGS, BGSG, BHGR, BHT, BLB, BMSG, BOSA, BSA, BSP, BTFU, CHSG, CMBS, CRAG, CSD, DCSA, DCTS, DMG, EA, FAG, FGD, FGG, FOSA, FPGR, GDH, GDU, GFDU, GFSD, GFSDD, GFSG, GFSU, GFTD, GLGR, GSG, HEG, HETD, HPSG, HWH, KES, KPGR, LESE, LHGR, LOCO, LOFT, LORS, NCRC, NU, ODT, OGF, OLHD, ORG, PBGR, PENS, PGBD, PGMD, RCG, RGR, RMD, RMD, SGAO, SGU, SHGR, SSA, STHP, STOB, T2T3, TAB, TALM, TPGR, UTW, WHAT, WOSG, YWS
I_SANDSTONE	ACHS, ALBR, ARS, ASG, BABS, BEAL, BHC, BMS, BNS, BPST, BRI, BRS, BT, CA, CM, CYBR, DAS, DCS, FO, HA, HABR, HAS, HHB, HY, KDM, LAQU, LGS, LNS, LTW, MG, MGLC, MKN, MXR, NS, NSI, NTC, OS, PES, PG, PLG, PS, RESA, SBR, SMG, SSG, STG, THSA, TRSD, UGS, UORS, WBS, WLSF, WPN, WRS
I_TERRACE DEPOSITS	3TMR4, AR3, AR4, CHMS, RTD, RTD1, RTD2, RTD3, RTD5, RTDU, RTS, TWGR, VLGR
Fill Groupings	
F_CHALK	BDMA2, CK, CKR, CSMA3, HCK, KU, LCK, LECH, LPBLL, LPMB, LSNCK, MCK, MR, MUCK, NCK, NPCH, PCK, RCK, SECK, SPCH, UCK, WMCH, ZZCH
F_COHESIVE	ABM, ABY, ACCO, ACM, ACU, ALF, ALGD, ALRT, ALV, ANSH, AS, ATF, AW, AYB, BABB, BAN, BCLC, BCMU, BDMA1, BKF, BNF, BOC, BRB, BRK, BRYD, BTMA2, BUSS, BVM, CBP, CBRD, CDF, CKF, CLEB, CLGB, CLSL, COLV, CORF, CWF, DHLS, DIAM, DVY, DYS, DYSM, ELM, ETM, FEFR, FOUN, GLLD, GLSC, GRAD, GST, GSTC, HEAD, HEAD1, HEB, HRR, JURA, KRS, KST, LAC, LASI, LCLM, LCM, LDE, LESE, MAAL, MARF, MCM, MDU, MEA, MFDC, MM1, MM3, MM4, MMG, MOI, OMEA, PCS, PEAT, PELC, PMLS, PNG, PTAL, RBDU, RG, RIDS, RTMA2, SAH, SAL, SBC, SKE, SLIP, SNT, TCF, TFD, TILL, TPT, TTB, TVY, TWM, UCM, ULC, WHG, WHI, WIDS, WIT, WL, WOC, WPIT, YF

Geological Grouping	BGS Geology Codes
F_GRANULAR	10FT, 27YD, 2FCC, 2FTC, 2FTV, 4FTC, 5FTC, AB, ABBR, ABDN, ABH, ABN, ABSG, ACHS, ACKW, ACR, ACTO, ALBR, ALC, ALY, ARS, ASG, BABS, BAS, BASG, BDS, BEAL, BFLS, BGGR, BGP, BGS, BGSG, BHC, BHGR, BHT, BLB, BLK, BMS, BMSG, BND, BNLS, BNS, BO, BOSA, BPST, BRI, BRL, BRS, BSA, BSP, BT, BTFU, BTH, BWL, CA, CARA, CARB, CB, CBL, CHSG, CL, CLR, CM, CMBH, CMBS, CMV, CR, CRAG, CSD, CU, CWRU, CYBR, DAS, DBLB, DCS, DCSA, DCTS, DMG, DST, EA, EDT, EDW, EN, EYCL, FAG, FCF, FGD, FGG, FLUV, FMCB, FO, FOSA, FPGR, GDH, GDU, GFDU, GFSD, GFSDD, GFSG, GFSU, GFTD, GL, GLGR, GNP, GOF, GOG, GOL, GRNT, GSCL, GSG, GSTL, GUN, HA, HABR, HAS, HEG, HETD, HHB, HPBR, HPSG, HVBR, HWH, HY, INO, IOGO, KDM, KES, KHS, KPGR, LAQU, LDVY, LELH, LGS, LHGR, LLKL, LLL, LLST, LMC, LMJ, LNS, LO, LOCO, LOFT, LORS, LTK, LTLS, LTW, LUDL, LUW, MCF, MDT, MDVS, MFSG, MG, MGL, MGLC, MKN, MRSL, MXR, NCRC, NMRN, NS, NSI, NTC, NU, ODT, OGF, OLHD, ORG, OS, PBGR, PENS, PES, PG, PGBD, PGMD, PLG, POAN, PRMT, PS, RCG, RESA, RGR, RMD, RMD, RMSM, ROX, SBR, SFG, SGAO, SGU, SHGR, SMG, SMGP, SSA, SSG, STAM, STG, STHP, STOB, T2T3, TAB, TALM, TBR, TGM, THSA, TLM, TPGR, TPSF, TR, TRIA, TRSD, TSL, TVF, UC, UCS, UDVS, UGS, ULL, UMAZ, UNL, UO, UORS, UTW, VOLC, WAWK, WBCT, WBS, WBY, WEN, WESH, WHAT, WLSF, WOL, WOSG, WPN, WRS, YWS
F_MADE GROUND	MGR, WMGR
F_OVERCONSOLIDATED CLAY	AC, AMC, AMKC, ASD, BAC, BLCR, BLI, BM, BMN, BNT, BOF, BWC, CHAM, FE, FMB, GAB, GLT, GRBL, GRF, GUGS, KC, KLB, KLC, KLOX, LC, LI, LIGO, LIO, LLIC, LMBE, MHC, MPMU, NEC, ODTL, OXC, PET, RB, RBLC, RLD, SAB, SASH, SLSY, SMD, STWE, THT, WBL, WC, WDC, WHM, WRB, WTT
F_TERRACE DEPOSITS	3TMR4, AR3, AR4, CHMS, RTD, RTD1, RTD2, RTD3, RTD5, RTDU, RTSG, TWGR, VLGR

Table 2 Morphology Class Definition

Morphology Class	Morphology Factor Range
A	0 – 0.25
B	0.25 – 0.50
C	0.50 – 0.75
D	0.75 – 1.50
E	1.50 – 3.00
F	3.00 – 6.00
G	> 6.00

Table 3 Weightings for each Observation Category

Observation Category	Weighting
Major Defects	1.0
Minor Defects	0.5
At Risk observations	0.1
Repairs	1.0

Table 4 Weighted Lengths per Slope Hazard Rating

Slope Hazard Rating	Weighted Length
Very High	≥ 6.88%
High	≥ 4.5 < 6.88%
Medium	≥ 2.57 < 4.5%
Low	≥ 1.52 < 2.57%
Very low	≥ 0 < 1.52%

Table 5 Weighted Lengths and Slope Hazard Ratings assigned to each cohort (colour coded by SHR)

Geological Grouping	Morphology Class						
	A	B	C	D	E	F	G
I_TERRACE DEPOSITS	0.00	0.03	0.06	0.13	0.28	0.30	0.80
F_CHALK	0.00	0.16	0.33	0.66	0.86	1.49	3.21
F_MADE GROUND	0.06	0.12	0.25	0.45	1.33	2.16	2.96
I_CHALK	0.01	0.01	0.02	0.07	0.37	1.64	3.07
I_SAND AND GRAVEL	0.04	0.09	0.18	0.37	0.82	1.69	3.00
F_COHESIVE	0.00	0.32	0.64	0.79	1.58	2.40	3.46
I_SANDSTONE	0.00	0.20	0.40	0.82	0.86	0.92	5.20
I_MUDSTONE	0.05	0.10	0.20	0.73	1.56	2.34	6.58
F_GRANULAR	0.11	0.21	0.42	0.83	1.05	2.68	5.00
I_CLAY	0.03	0.06	0.12	0.26	1.03	2.97	4.50
F_TERRACE DEPOSITS	0.00	0.11	0.22	0.33	1.99	3.25	4.50
I_OVERCONSOLIDATED CLAY	0.02	0.04	0.07	1.85	2.53	3.76	5.37
I_OTHER ROCK	0.03	0.06	0.12	0.25	0.95	1.35	7.66
I_MADE GROUND	0.02	0.03	0.04	0.05	0.06	3.82	28.92
I_LIMESTONE	0.00	0.62	1.25	1.70	2.00	2.97	14.07
I_ALLUVIUM AND PEAT	0.00	1.30	2.60	3.85	5.94	6.81	26.76
F_OVERCONSOLIDATED CLAY	0.00	0.33	0.73	1.92	6.96	10.12	17.39