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Description of Ax-les-Thermes cuttings for a Rock fall hazard Benchmark case

Muriel GASC-BARBIER¹, Véronique MERRIEN-SOUKATCHOFF²

Keywords: benchmark, rock slope, natural hazard

This paper will present the site, the geological and structural data that constitute a benchmark on rock fall hazard. All the data provided come from a site that was studied for the bypass of Ax-les-Thermes (Ariège, France).

1 AIM OF THE BENCHMARK

Starting from fracturing data and a slope (or underground) geometry, estimates of the rock fall hazard can be ran under different methodologies, using various software. The idea of this benchmark is to compare practices in:

- Regrouping fractures in families:
- Consideration or not of sampling bias
- Mechanical properties taken into account for the discontinuities (deterministic or stochastic)
- Rock fall hazard estimation
- The stability indicators given from the stability analyses. These indicators can be varied for example the results can be expressed in terms of:
 - biggest unstable block
 - more frequent block (possibly with a confidence interval)
 - total unstable volume (weight) and dispersion around this volume
 - number of unstable blocks
 - blocks displacement and movement types
 - local or Global Safety Factor
- The inclusion of a reinforcement (bolting) and the presence of water in the hazard assessment
- software used for these different steps
- How the geometrical, and mechanical properties uncertainties are taken into account

We propose to work on data collected before excavating a high cutting in a migmatitic rock excavated for a bypass in the French Pyrenees where 861 fracture measurements were performed (Gasc-Barbier et al., 2008). Another benchmark on rock fall hazard in underground context will also be proposed based on the data collected before and during the excavation of St Beat tunnel, also in the French Pyrenees.

2 DATA SURVEY

2.1 Location

Ax-les-Thermes lies 130 km south of Toulouse, just 30 km from the border between France and Andorra, in the primary axial zone of the French Pyrenees. Three orogenic phases that affected the entire mountain lead in considerable fracturing of the site, which is apparent in different forms depending on the area studied.

2.2 Geological information

The bypass encounters Quaternary superficial formations, fluvio-glacial materials and then the rock substratum, where the benchmark takes place. The slope under study (Esquirollet cuttings) is mainly composed of augen gneiss and leptinic gneiss, in practice it is impossible to separate them into two distinct areas and hence the formation is best described as migmatite (in the widest sense). All these rocks are heavily fractured.

¹ GASC-BARBIER Muriel, Cerema, Toulouse, F-31400, muriel.gasc@cerema.fr

² MERRIEN-SOUKATCHOFF Véronique, Cnam, Paris, F-75002, veronique.merrien@lecnam.net

2.3 Scanlines and borehole images

For several reasons, excavation of the site was stopped when the proposed 42 m high cutting was 15 m high. This provided an opportunity to realize scanlines on the new cuttings to obtain statistical information on the joint properties. A scanline is a horizontal line (of about 10 m) drawn on a rock face (Priest, 1993). The line can, in fact, be vertical or horizontal but should have spatial references (dip and dip direction if possible). As recommended by many authors (Aftès, 2003, Priest, 1993, Khanlari et Mohammadi, 2005), the standard properties of all the joints that intersect the line are mapped: dip, dip direction, spacing, trace length, weathering, aperture, infill and roughness. Several lines in different directions were drawn in order to try to intersect the maximum number of joint sets. In this particular case and because of the geometry of the site, the scanlines were drawn on three faces as depicted in Figure 1 but their lengths were quite different. It was not possible to use vertical lines because of the difficulty of access. In total, 11 scanlines (from 6 to 30 m) were plotted; including 856 discontinuities over 181.5 m. Borehole images, also allow having a kind of "scanlines". Two boreholes were inspected by camera allowing an enhancing of the data and "internal" data of the rock mass. All the data can be found on https://www.researchgate.net/profile/Muriel_Gasc-Barbier/publications.

2.4 Other provided information

Other data are provided on https://www.researchgate.net/profile/Muriel_Gasc-Barbier/publications: Elastic waves velocities, uniaxial and Brazilian tests and shear tests on natural joints.

2.5 Other provided information

Figure 1a shows a 3D view of the site when scanlines were drawn. Figure 1b gives the proposed geometry of the cutting to be reinforced for the benchmark.

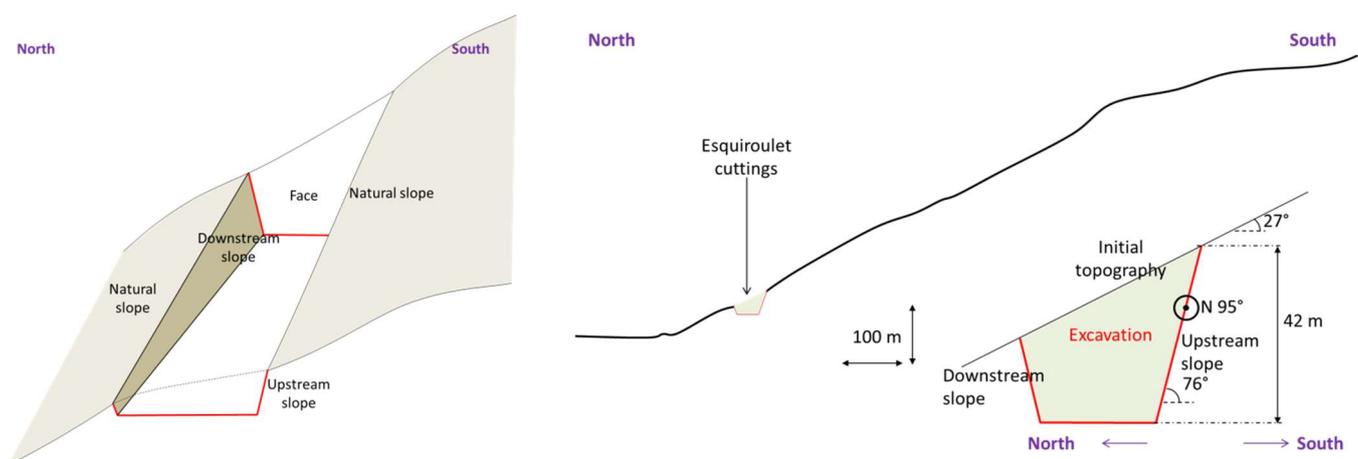


Figure 1: Ax-les-Termes cuttings – a- localization of the different scanlines, b- proposition of geometry for the benchmark

3. CONCLUSION

This benchmark is conducted under the supervision of the co-authors of this paper in 2016 and main conclusions are awaited at the beginning of 2017. Please contact the authors for information and participation to the benchmark.

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