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Rockfall susceptibility analysis for establishing a detailed zoning in an urban area (Solà d'Andorra, Principality of Andorra)

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At the Solà d'Andorra, a urbanized scenario which the rockfalls phenomena are highly active, we have been analysed the susceptibility of rockfalls. The susceptibility analysis establishes the areas that are prone to rockfalls, either where they set-off or where they reach (Brabb, 1984). As the exposed urban area zone is located in the run-out, the reach susceptibility analysis prevails in this study.

For the reach susceptibility analysis a suitable model has been selected from: (a) two empirical models, (b) a numerical model of rockfall simulation and (c) a heuristic model. The empirical "shadow angle" model (Evans & Hungr, 1993) is the one that has given more satisfactory results and has been more speedily applied.

From the different values of shadow angles, obtained from the fifteen documented rockfalls, five levels of reach susceptibility have been established for rockfalls with volumes lower than 1000m3: (i) very high ($>33^{o}$), (ii) high (33-32^{o}), (iii) medium (32-30^{o}), (iv) low (30-27.5^{o}), (v) very low (27.5-25.5^{o}). Areas located under a "shadow angle" lower than 25.5^{o} are not within the rockfall susceptibility reach zone.

These characteristics shadow angles lets drawing a susceptibility rockfall map which are used for risk management purposes.