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A methodology to quantify cost effectiveness of engineering interventions for landslide remediation and prevention of road cuttings in least developed countries

Ellen Robson, Stefano Utili, and David Milledge
Newcastle University, Civil Engineering, Hexham, United Kingdom (e.b.robson2@newcastle.ac.uk)

Landslides move soil and rock down slopes, and where the built environment and society coincides with their pathways, the result can cause severe economic and social devastation. The losses incurred vary greatly depending on landslide type and scale, as well as the economic and social factors of the area affected. One major source of economic loss from landslides is damage to transportation infrastructure, incurred both directly and indirectly. In hilly areas, railways and roads are commonly constructed at the foot of slopes and often require artificial cuttings. Direct costs are incurred through damage to the infrastructure, human injury or death and vehicle loss; indirect costs through delays (especially for goods vehicles), use of alternative routes (additional fuel or travel fare and loss of productive time) and inability to work. Landslide prevention and remediation activities vary with the type of landslide, location and, crucially, the funds available. Cost-effectiveness is a critical parameter when deciding on the most appropriate slope stability solution. A remediation or prevention activity is cost-effective when the potential economic losses resulting from the landslide occurring (i.e losses if a landslide happened) exceed the cost of the activity itself. Cost-effective engineering interventions of landslides are crucial for the sustainable growth and maintenance of rural roads in less developed countries, that are compounded by a lack of funding. Landslides that block these key rural roads can hamper local and country-wide socio-economic prosperity. Due to the lack of coherent landslide databases, as well as information on the cost of mitigation implementation, estimating cost-effectiveness is not straightforward. We collate and compare the cost and success of road-related landslide remediation and prevention methods in countries of varying “development” status and with different environments. The aim of this work is to develop a methodology to quantify the cost-effectiveness of landslide engineering interventions, that is viable for use in least developed countries.